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ON THE COVER

THE 362-mile railroad that has been thrust northward from Seven Islands, ue., into Labrador to bring out iron e is strictly "on its own." At one end meets the St. Lawrence River; at the her there is only wilderness. With no nnecting rails, its rolling stock had to delivered by water, and our cover ture shows a locomotive about to be down on rails at shipside. To begin th, there will be 49 of these diesel actors. A 1500-horsepower unit was ected because it is suitable for either itching or main-line haulage service. his interchangeability will simplify intenance problems and reduce shop-ility requirements.

IN THIS ISSUE

PROBERS beneath the muskeg of Canada's far-flung Pre-Cambrian ield continue to make startling min-al discoveries. Two decades ago the phasis was on gold; now it is on then tle-known metals such as titanium and anium. But keeping company with ese aristocrats is plebeian iron, the ckbone of industry. In Labrador the archers located a ferrous deposit of ly colossal size, and little time has en lost in bringing it into production en though the cost will come to around 00 million before a pound of ore is ought out. American steel companies, hich will take the bulk of the ore, are, derstandably, footing most of the de-lopment bill. Leading off our editorial ntents is the first of two articles on is outstanding project.

•

PEOPLE in the Far North don't wor-ry much about food spoilage. Fish game is simply left outdoors, and ture's refrigerator does the rest. An servant trapper, Clarence Birdseye, ted that quick freezing locked in the shness and tastiness of meat and fish d later made it the basis of what has ossomed into a billion-dollar-a-year in-stry. Page 194.

•

THE Raymond Concrete Pile Com-pany has built up a highly interest-specialty business in the construc-n industry. The world over, it has iven to firm footings steel-and-con-te stilts to take the load of structures at rise on loosely consolidated earth. Muskegon, Mich., it has sunk nearly piles to the almost incredible depth 200 feet to carry the weight of a wer-station addition. Page 197.

IRON ORE FROM LABRADOR

Building 362-mile railroad into remote area heads 200-million dollar development program

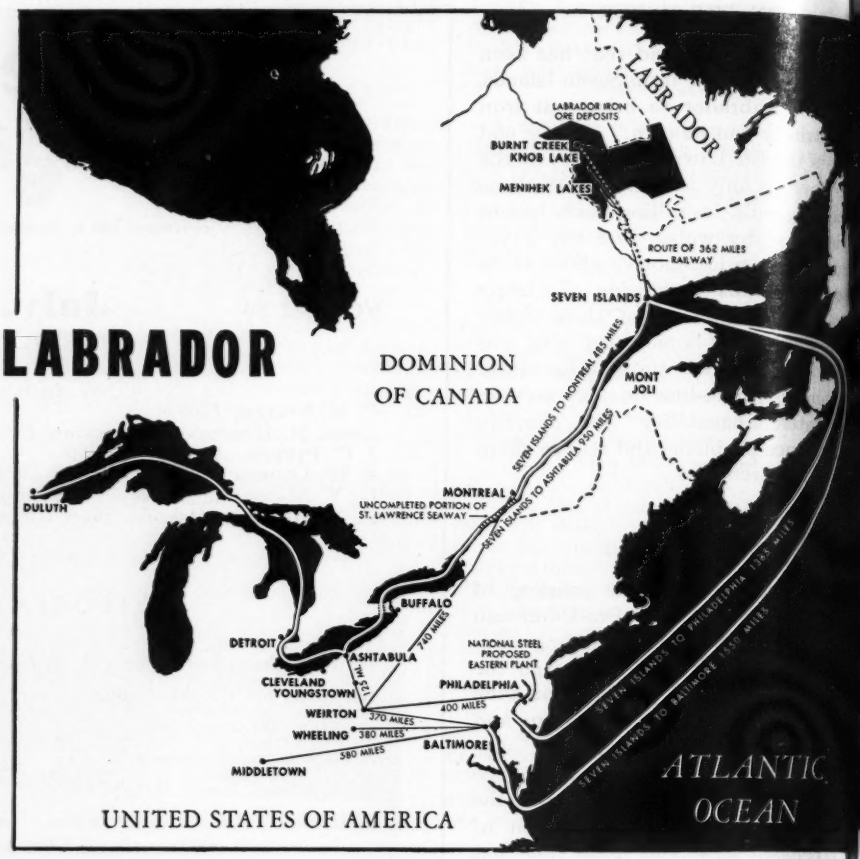
J. P. SMALLWOOD

"IRON ore shipments over the railway connecting the Labrador-Quebec mining regions with the port of Sept Iles (Seven Islands) on the St. Lawrence River are expected to commence in the latter part of 1954."

With this brief statement the directors of the Labrador Mining & Exploration Company Limited summed up a recent report. It was presented "on behalf of the Board" by Jules R. Timmins who had faith in the economic value of a field of iron ore so remote that few men of his day saw its immediate importance as a paying mine. Mr. Timmins invested millions of dollars and rounded up millions more to form the Iron Ore Company of Canada, which is making productive an area that, until several years ago, was considered barren and was called *Ungava*, far-away place, even by the few Indians who visited it.

But since 1950 men and machines have been thrusting 362 miles of steel rail into the Canadian hinterland north from Seven Islands, Que., roughly 500 miles northeast of Montreal and 1000 miles north of New York City. They have built two hydroelectric stations, one at each end of the line, as well as extensive crushing, grading and loading facilities for the iron ore that is the cause of this tremendous activity—$200 million worth of construction and mine development work aimed at replacing the dwindling 50-year-old Mesabi Iron Range in northern Minnesota and, for both economic and security reasons, at making the North American steel industry less dependent on ore from overseas countries such as Sweden, Liberia, Brazil and Venezuela.

Mesabi is not dead yet; in fact, estimates give it at least twenty years more of high-grade ore production, and plans



LOCATION MAP

Geographical relationship of the Quebec-Labrador iron-bearing area to the large United States steel-producing centers. Note the direct, protected route to the Ohio, Illinois and eastern Pennsylvania mills that will be provided by the construction of the St. Lawrence Seaway. Until it is available, ore consigned to these districts will be transferred at Montreal from large vessels to lake freighters. The outside shipping routes may be used to deliver ore to the eastern-seaboard mills. Knob Lake (the town of that name has been renamed Schefferville for the Bishop of Labrador) is 718 air miles from Montreal.

OPERATION AIRLIFT

Without airplanes the fast construction pace could not have been maintained. As early as 1946, a tractor was flown into the remote interior. Because the United States was interested in a new source of iron ore, our Air Force loaned a Fairchild "Flying Boxcar" in 1951, and in 49 flying days it carried 1½ million pounds of freight. At its height, the IOCO subsidiary, Hollinger Ungava Transport, had fifteen aircraft and 200 employees. Planes are still moving freight but will be supplanted soon by the railroad. The picture shows a DC-3 taking off at Wacouna airstrip, about midway on the inland journey.

CARVING RIGHT OF WAY

At the peak of operations, 4000 men and several hundred machines were pushing the all-important railway into the wilderness. The heaviest going was encountered along the lower reaches of the Moise River, where the steepness of the valley walls turned drillers into acrobats. The view at the left shows a Canadian Ingersoll-Rand Wagonjack clinging flylike to an almost sheer rock wall with the aid of a line run from a built-in air hoist. The other view pictures a group of Wagonjack drillers at Mile 55 in a wintry setting. The stand of birches in the background is rare in this section where evergreens predominate.

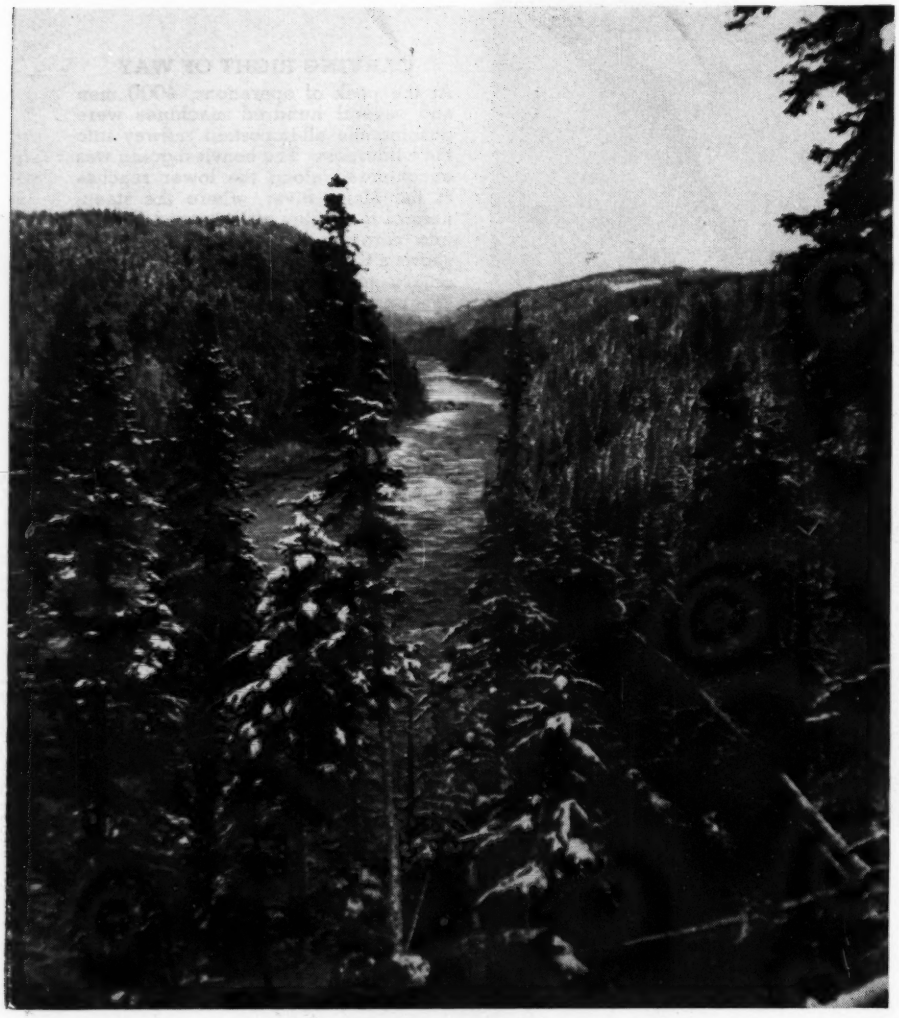
re afoot for economically upgrading its w-grade taconite ore thereafter. But this tense and fast-moving period, OCO's new Quebec-Labrador project omes of age none too soon to supplement the two-billion-odd long tons of igh-grade hematite that Mesabi has ielded to date.

As late as 1945 experts stated that it ould be 50 to 75 years before the United tates would need iron ore from Canada. ut they failed to evaluate that two orld wars and their associate economic ooms would make a heavy drain on omestic supplies or to realize that steelaking capacity in that country would se to about 120 million tons per annum the end of 1953. Now, in the interests continued economic stability and naonal security, those experts are among e first to approve Quebec's output of million tons per year and to urge the roposed expansion to 20 million tons.

The bulk of the ore will be marketed the United States; later some will go Britain and western Europe. The ominion will not become a customer ntil her steelmaking facilities have rown considerably. There is an overll production deficit of only 200,000 ns per year from existing mining propties in Canada. However, IOCO is tting aside large reserves for ultimate se there and is coöperating with Laval niversity in Quebec City and the Mines epartment of Quebec in research work imed at the successful absorption of ngava ore within the province.

The most spectacular feature of the project is the remoteness of its immense proven ore body—500 million long tons —in an area known as the Labrador Trough. Two thirds of the deposit is in Quebec; the other third in Labrador. The railroad that had to be provided before the first ton of ore could be marketed—the first major railway job in North America since the Rocky Mountains were spanned with steel 50 years ago—was built in rough country and, in addition, completely financed by private capital. Access was so difficult that transportation had to be bolstered by the largest civilian airlift ever to be put into operation. Some of the ablest construction and mining men on the continent have literally lived with this job, which has been called the biggest initial mining development ever undertaken in Canada. Among these is IOCO's general manager, W. H. (Bill) Durrell, with many years of experience in the North Country including the building of the airport at Goose Bay, Labrador, and other work in Labrador and Newfoundland.

The story of New Quebec-Labrador iron dates back to 1866-70 with the annual journey to the area of The Rev. Louis Babel. His rough maps to some extent prompted the visit of Dr. A. P. Low, of the Geological Survey of Canada, who spent the field season of 1894 there making a topographical and geological survey. Low's contribution was not the discovery of iron ore itself, but a report on the favorable nature of the geology for its occurrence. It was his report that helped to inspire the forma-



A RAILROAD NOW RUNS HERE

Looking northward along the Moise River from the approximate site of the northern portal of a 2250-foot tunnel at Mile 12 on the railroad. The right of way had yet to be blasted out of the bluff. Throughout this stretch a shallow mantle of soil on top of the granite-gneiss rock supports a heavy growth of spruce. This type of terrain prevails until high land is reached at about Mile 150.

tion in 1929 of the New Quebec Company for the exploration of the region by an expedition headed by Drs. W. F. James and J. E. Gill. That party found outcroppings of iron ore close to Ruth Lake, Labrador.

Strangely enough the beginnings of the present project hinged on a search for gold and base metals by the Labrador Mining & Exploration Company that was organized for that purpose in 1936. Dr. J. A. Retty, a persistent Canadian geologist, assisted by one of his students, Albert E. Moss, now Doctor Moss and chief geologist for IOCO, conducted this first detailed geological work in a bleak tundra aided only by Low's maps drawn on a scale of 25 miles to the inch. Retty discovered ore in 1938, and on his recommendation a license was obtained for 3900 square miles from the Quebec Government. Actually, he was led to the ore by an Indian trapper called Mathieu Andre who is now chief of a local tribe, the Montaignais.

Geologically, the surface rocks of the area are ancient gneisses of the Pre-Cambrian era. In the course of time, while the region was submerged and covered by an arm of the sea that ran in a northwesterly direction and was about 500 miles long and 100 miles wide, 2000 feet of sediment was laid down. One of the beds, about 400 feet thick, has an overall iron content of 30-40 percent and is known as the "iron formation."

Either before or after the land emerged from the sea the rocks were compressed by shrinkage of the earth's crust, with the main force bearing from the northeast, into a series of faults and folds. Further shattering promoted leaching, which removed undesirable silica and increased the iron-ore concentration to 55-65 percent. The ores are oxides of iron of varying colors with brown predominating, and approximately 12 percent or 53 million tons are manganiferous.

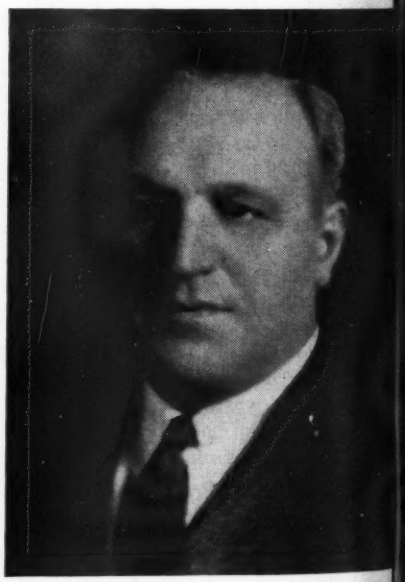
Despite the vastness of the deposit, its economic importance was not readily appreciated and capital for its development was not quickly forthcoming. Investors balked at taking a chance on th rich but remote land—afraid of the col sal expenditure necessary to provide ra road and ore-handling facilities befo the first ton could be sold.

It was his vision and courage th prompted Jules Timmins, member of famous Canadian mining family an president of Hollinger Consolidated Gol Mines, to take the first calculated finan cial risk that germinated the giganti IOCO operation. Assuming that the ven ture would appeal to the United State the country that would be the ultimat chief customer for ore, he approache and won the support of George M. Hum phrey, president of the M. A. Hanna Company, of Cleveland, Ohio. The orig inal 1942 investment of $10 million was intended solely for further exploratory work to prove the value of the deposit and thereby attract the estimated $200 million necessary to carry out the follow ing construction program:

Railway	$75,000,000
Rolling stock and other railway operating equipment	50,000,000
Harbor facilities and ore docks at Seven Islands	15,000,000
Power development, town sites, mining equipment, etc.	60,000,000
	$200,000,000

To date, $45 million has been spent o wages and $155 million on equipmen and supplies.

For some years after the Hollinge Hanna tie-up, work was confined t geological mapping and prospecting be cause of World War II. A diamond drilling program was launched to de limit the ore body, and good result sparked further intensive drilling in 194



JULES R. TIMMINS

President of Hollinger Hanna Ltd., and Hollinger Consolidated Gold Mines and spark plug of the huge development program. He invested his own money in the venture, then interested American steel companies to do likewise.

The findings therefrom inspired the formation in 1949 of the Iron Ore Company of Canada, composed of five American steel companies that joined Hollinger Hanna for the express purpose of preparing for commercial production. Humphrey* was elected president and Jules Timmins vice-president. Another company, Hollinger Hanna Limited, was organized to manage the operation and mine the ore on a fee basis.

In magnitude, the IOCO ore field compares favorably with the Mesabi. The latter is 110 miles long and from 1 to 5 miles wide, while the Labrador Trough is 225 miles long and from 10 to 60 miles wide. But Mesabi's 70-mile productive zone is overshadowed by IOCO's 90-mile stretch of high grade, which shows promise of continuing at both ends, and also has a large tonnage of marginal material from which excess silica can be removed by washing.

The remoteness of the area must have staggered the key executives of the four companies that had been chosen to build the railroad and other facilities. Picture them gathered in a central office in the sandy, wind-swept fishing village of Seven Islands in the late 1950's planning the task before them. First they envisioned the line forging its way up through the granite barrier of the Pre-Cambrian shield and then through shaky, treacherous muskeg to the mining area at Knob Lake with grades not too steep and curves not too sharp for the heavy cars of ore. At the northern end they pictured a little Chicago of switching and gathering yards, Mesabilike strip mines and a complete town set down in a wilderness called "The Land of Cain" by its first visitor, the explorer Jacques Cartier, in 1535.

Their job also called for the construction of two hydroelectric stations to harness the energy locked in the region's tumbling white water for the job at hand. One was to be built at the north end of the line to generate power for the mine and town. The other, now in use, supplies the boom town Seven Islands and will operate the ore-handling plant, including conveyors, crushers and shiploading machinery.

The quartet of contractors consisted of the Cartier Construction Company of Montreal, Que., and the MacNamara Construction Company, Toronto, Ont., both with extensive grading experience in eastern Canada; the Fred Mannix Company of Calgary, Alta., veteran of many grading jobs in western Canada; and the Morrison-Knudsen Company, Inc., of Boise, Idaho, whose operations are world-wide and varied. This group adopted the short title C.M.M.K., a combination of the first letters of the firm names, and set to work. Mannix Company's James G. Pickard, a man with 38 years of experience, was appointed project general manager; Harold MacNamara of MacNamara Construction became assistant project manager; Fred C. Mannix, whose father had helped to build the Canadian Pacific Railway, was made president and general manager; and W. E. Ross of Morrison-Knudsen was given the exacting post of chief engineer.

C.M.M.K's biggest job by far was the railway whose contribution to the development of Canada has been summed up as follows by Premier Maurice Duplessis of Quebec. "The railroad will

*In January, 1953, Mr. Humphrey resigned to become Secretary of the U. S. Treasury. He was succeeded as president of the Iron Ore Company by J. H. Thompson, who is also president of the Hanna Coal & Ore Corporation.

LICKING TRANSPORT PROBLEM
Swamp buggies (left) were used to good advantage in crossing muskeg and bucking deep snows. As rails advanced northward, camps were skidded up the line by tractors (below).

PHOTO, JOHN A. RODRIGUE

BEGINNING OF A PIER

At Point aux Basque, adjacent to Seven Islands, IOCO has built piers with 1600 feet of docking space and the government has provided an additional 600 feet to handle the expected increase in general shipping. This picture shows stringers being laid on a filled section. The booming community, although it was founded more than 300 years ago, had only about 300 inhabitants until current activities began and its only industry was fishing. Here ore arriving from the north during six months of the year (about 11,000 tons per 104-car train) will be transferred to ships. Total construction expenditures in the area will reach $15 million.

PHOTO, JOHN A. RODRIGUEZ

LAYING TRACK ON BRIDGE

This 710-foot span at Mile 12 was thrown across the Moise River nearly 140 feet above the stream. It is one of twenty bridges of varying sizes. Construction of the line required 53,000 tons of rails and more than 1¼ million ties. Some of the latter were cut from trees felled in clearing the right of way; others were shipped from as far away as Texas. By spiking the rails to ties in 39-foot sections the contractors were able at some periods to lay track at an average rate of 2 miles a day.

not only benefit the companies interested in the huge iron development but will open all Ungava to commerce, industry and civilization." No jitney line,* it is of standard construction with 132-pound main-track rails, the heaviest now used in Canada. It has treated ties, 14-inch tie plates and 6-hole joint bars. The roadbed is ballasted with local gravel, which will be topped by crushed rock when it has settled. The maximum adverse grade against load does not exceed 0.4 percent. Over this line will pass the heaviest trains ever run consistently in North America. Operation will be delegated to a subsidiary company—the Quebec North Shore & Labrador Railway.

DRIVING LAST SPIKE

Jules Timmins driving the final spike in the railroad at Knob Lake, Labrador, on February 14, 1954. Back a little at the right is William H. Durrell.

Head of the railroad company was Hector McNeil, a man "long" on experience in this field, who was borrowed from the Canadian National Railway. He teamed up with John A. (Jack) Little who was appointed assistant general manager of the Iron Ore Company and given the job of getting the line built.

The 95-ton ore cars will run on roller bearings and are of the solid-box welded type larger than any now in service in the Dominion. This is the first application of roller bearings to all the freight cars operated by one railroad. They are expected to reduce maintenance by cutting starting resistance more than 80 percent and will also permit a 30 percent increase in running speed. For better braking, steel wheels with a diameter of 36 instead of the standard 33 inches are provided because they assure better distribution of weight per inch of circumference. Cars are equipped with empty and load clasp brakes and semitight lock couplers.

Locomotives of the 1500-hp switcher type will be used for both road haul and yard switching service. This will permit an interchange of units between the line and the yards, as well as centralized maintenance in the main locomotive and car shop at Seven Islands. Trains will be controlled by the signal system commonly known as C.T.C., aided by radio. Powered remote-control switches will handle sidings for the passing of cars at the south end; spring switches at the north end.

Operation will begin later this year over two subdivisions, each 180 miles long. Loaded trains will make the trip in fourteen hours and empty ones in twelve. When production reaches the planned 10 million tons a year, it will be necessary to run seven trains each day

*To overcome the "remoteness" factor and the subsequent high capital expenditure, IOCO must be prepared to mine and ship a minimum of 10 million tons of ore per year to ensure a fair return on the investment.

in both directions. Operating rolling stock consists of 49 diesel locomotives, 20 cabooses and 2000 ore cars. Construction and maintenance rolling stock includes 175 ballast cars, 50 boarding cars, 20 pneumatic dump cars, 100 flatcars, 15 tank units and 20 boxcars, as well as two 250-ton wrecking cranes.

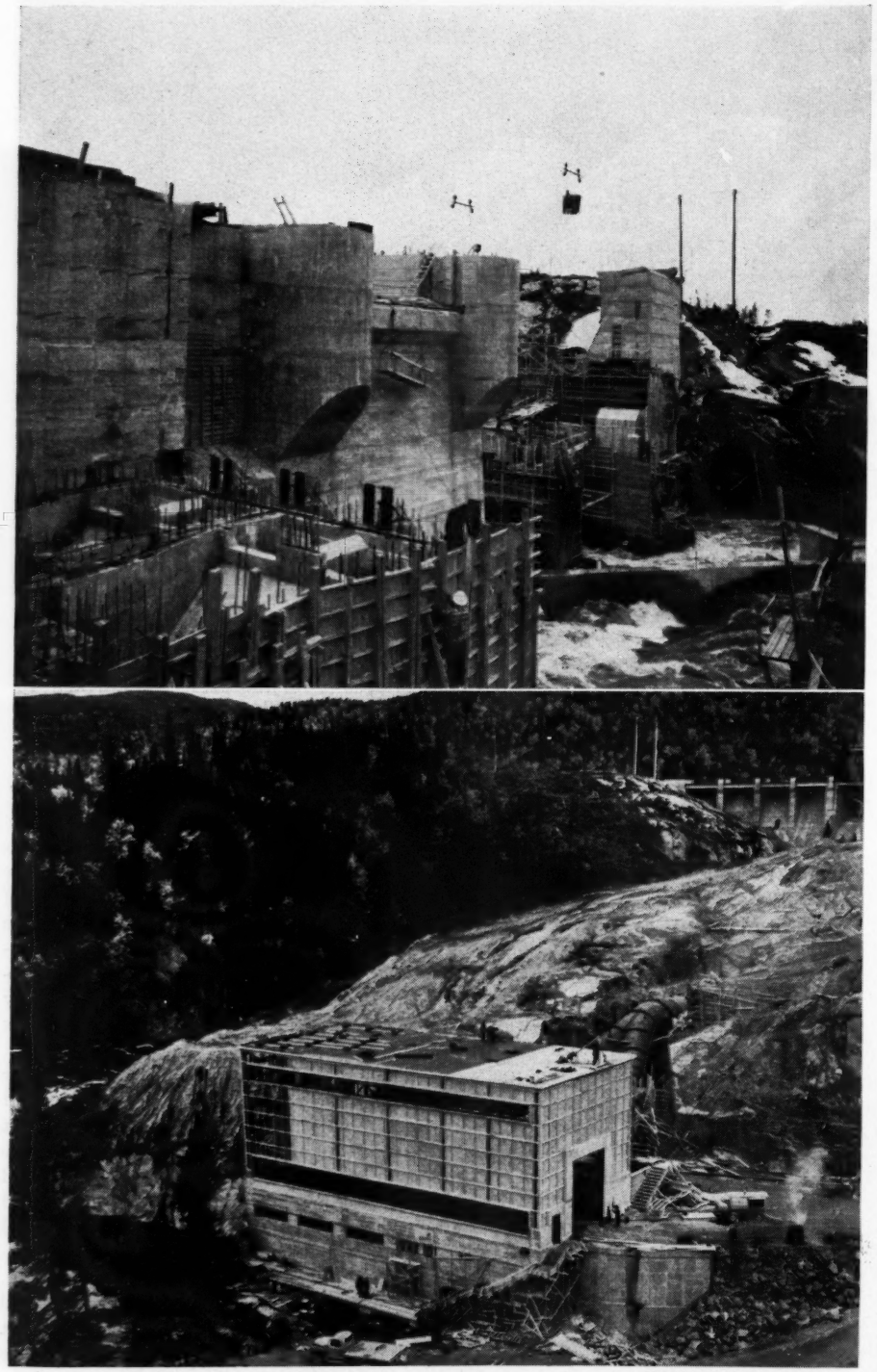
One of the preliminary steps in getting the construction ball rolling was the assembling of equipment, and the first shipments were unloaded on the ice in Seven Islands harbor during the winter of 1950-51. As usual, wherever large masses of rock must be drilled and blasted, compressed air got the nod and a battery of portable units was assembled. More than 35 of these were supplied by Canadian Ingersoll-Rand Company, which also provided around 40 Model JHM wagon drills that were utilized largely in excavating along the sloping sides of gorges and at the powerhouse and two dam sites. Secondary drilling was done by Jackhamers, and Jacklegs were used wherever jutting rock had to be removed to maintain grade and to clear the right of way.

About ten small automotive Type 30 compressors were placed at strategic points on the job to furnish air for a variety of other pneumatic tools and shop equipment such as utility hoists of different sizes, wood borers, drills, riveters and rivet busters, Impactools for speedy nut running, concrete vibrators and chippers. Among the heavy earth-moving facilities were 76 tractors, 40 dump trucks and 29 shovels ranging in capacity from ¾ to 2½ cubic yards. There were also about 160 lighter trucks and cars including six snowmobiles. Fuel for this equipment was stored in eight conveniently located 3500-gallon tanks.

Means of access was the first problem that faced the contractors. There were no roads in that land of spruce, rock and muskeg. The rivers boiled with rapids and even the native Indians took a month to travel the first 150 miles inland by canoe. How was an army of men, machinery and supplies to keep moving in such rugged country? That was where the airlift, that has played such an important part in opening up Canada's mining country, came to the rescue.

GEORGE M. HUMPHREY

As president of M.A. Hanna Company, of Cleveland, Ohio, he joined with Mr. Timmins to give the project needed financial support when it was still in the planning stage. Mr. Humphrey is now Secretary of the Treasury of the United States. Early in 1953 he was replaced as head of the Iron Ore Company of Canada by J. H. Thompson, who also succeeded him as president of the Hanna organization.



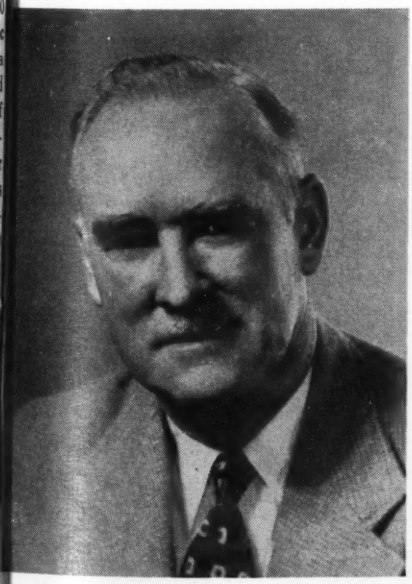
PHOTO, JOHN A. RODRIGUEZ

MARGUERITE DAM AND POWERHOUSE

Fifteen miles west of Seven Islands has been built a hydroelectric plant with about 30,000 hp of generating capacity to furnish energy for the operations at the railroad-boat terminal. The head on the turbines was obtained by damming the Marguerite River. The station will be owned and run by the Gulf Power Company, a joint venture of IOCO and the Gulf Pulp & Paper Company. Near Burnt Creek, at the northern end of the railway, a dam and 12,000-hp powerhouse have been erected.

An air line called the Hollinger Ungava Transport (HUT) was formed as an IOCO subsidiary. It has grown to include fifteen planes of varying types, fourteen runways at important spots along the railroad right of way and 200 employees, of which 75 are pilots. This service has made transportation history by keeping the job rolling on schedule. Since its organization in 1948, HUT has flown a total of 59,000 hours and carried 141,000 passengers and 92,000 tons of miscellaneous freight (184 million pounds). In 1953 its planes logged 7,851 air-hours, maintaining a 24-hour schedule to move 83 million pounds of cargo, which does not take into account material transported by small aircraft. In the same period Canada's largest regular commercial air line carried only about one-seventh of that amount of freight. Another feather was placed in HUT's cap by General Manager W. H. Durrell at a recent annual meeting when he said: "Flying was done under hazardous conditions, in a country noted for its poor weather, and we are happy to say that in our years of operation not a single fatal accident has occurred."

Aeronautical equipment includes five Douglas DC3's of which four are stripped inside for cargo and one is rigged as a fuel "tanker." There is one Canso for amphibious operations. Lighter aircraft—two Beavers, two Norsemen, one Bellanca and one Stinson—are used with floats, skis or wheels, depending on the season, for scouting, supervision, servicing surveying and exploration parties, and even for spraying dope like crop dusters to cut down the viciousness of that north country's menace, the black fly. A Lodestar equipped as an executive plane and two helicopters complete the roster.



WILLIAM H. DURRELL
General Manager of IOCO. He gained wide experience in the construction industry across Canada's northland on jobs including the building of the airport at Goose Bay, Labrador.

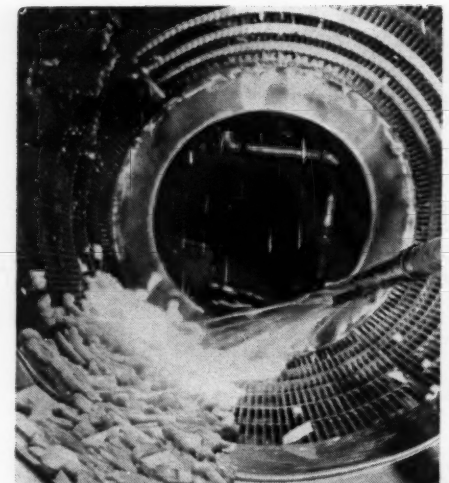
EQUIPMENT DEPOT
One of the chief tasks during the winter of 1950-51 was the assembling of construction equipment at Seven Islands for use in building the railroad and facilities for mining and handling the ore. Shown are portable compressors and wagon drills, harbingers of heavy-rock work. Most of them were flown to intermediate points on the railroad route.

Heading this hard-working aircraft group is Charles Hoyt, a former Royal Canadian Air Force wing commander and veteran of World War II's transatlantic ferry service. The base of operations is an erstwhile R.C.A.F. training station at Mont Joli on the south shore of the St. Lawrence River. Personnel and equipment for the air lift arrive there by rail or at Seven Islands by boat. Some pieces of freight, weighing as much as 50 tons, had to be partly dismantled for loading or cut apart with acetylene torches and welded together again on the job. This also applied to a 225-foot steel radio tower. Tractors were brought in minus only their track pads and drawbars — they were driven on and off the planes. Large earth-moving scrapers were similarly transported — they fitted with only 1 inch to spare on each side.

During 1952, seventy thousand bags of cement were flown 300 miles to the Menihek Dam, 30 miles south of Knob Lake. Thus men and equipment were leapfrogged by air ahead of the main working area. Food and camp facilities, compressors and tractors, drills and bits, in short, everything they needed, greeted the gangs as they moved by stages up the line. At first air transport cost 70 cents a pound, but later it was trimmed to as little as eleven cents.

(To be concluded in August issue)

DR. J. A. RETTY
Geologist who proved the economic value of Ungava's ores by his field work.



THEY'LL BE FRENCH FRIES
Here sliced potatoes for quick-frozen french fries are being washed prior to cooking. Tiny slivers that are removed by the water jets end up as frozen whipped potatoes.

BIRTHDAY FOR FROZEN FOODS

Industry founded by Clarence Birdseye has had remarkable rise in 25 years

THE frozen-foods industry, which is observing its twenty-fifth anniversary this summer, is now in the billion-dollar-a-year-sales class and is growing at a continually accelerating pace. It has had a marked effect on the nation's eating habits, eased the housewife's work, changed long-established merchandising methods, profoundly affected agricultural, stock-raising and fishing pursuits and either started or given impetus to several other industries.

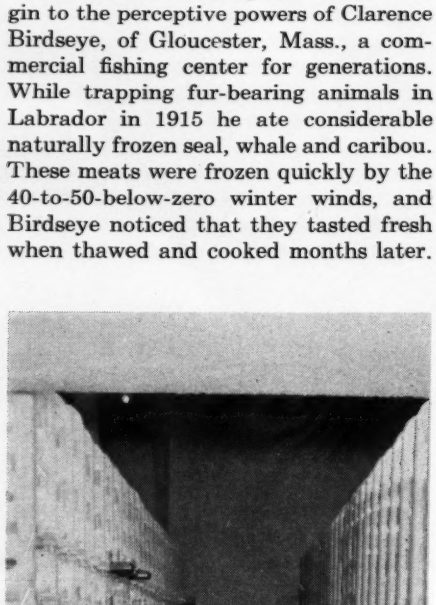
Last year the average American ate 36 pounds of frozen foods chosen from among 300 varieties marketed under 1500 brand names. The products ranged from vegetables, fruits, meats, poultry, fish and other seafoods to precooked edibles such as chicken à la king, beef pies and whipped potatoes. One hundred leaders of the industry who celebrated the quarter-century anniversary in New York last month were served a luncheon that came entirely from the freezers of the host packers. It consisted of grapefruit juice, fish sticks, egg rolls, duckling, peas, lima beans, peaches and ice cream.

The introduction of frozen fish sticks a few months ago marked the first new development in processing one of man's oldest foods in more than two decades. The sale of a billion sticks is forecast for 1954. Fish consumption, which has been around 10 to 12 pounds per capita for nearly 50 years, shows signs of increasing by 50 percent because freezing has simplified its preparation in the kitchen and insured freshness. It was predicted at the luncheon that sales of all frozen foods will reach five billion dollars in 1959, and the advertising budget for this year was estimated at $25 million.

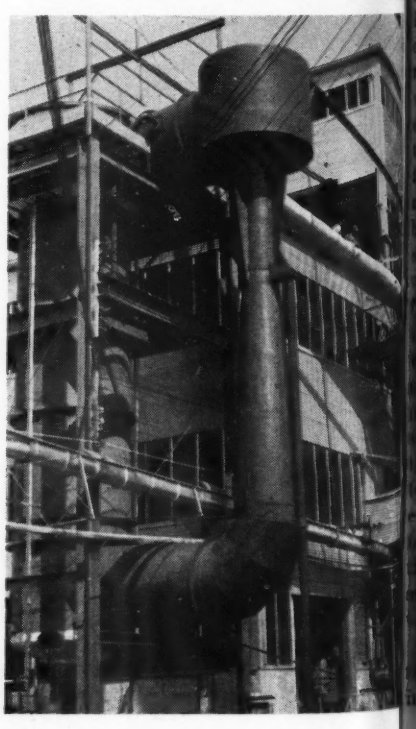
This new industrial giant owes its origin to the perceptive powers of Clarence Birdseye, of Gloucester, Mass., a commercial fishing center for generations. While trapping fur-bearing animals in Labrador in 1915 he ate considerable naturally frozen seal, whale and caribou. These meats were frozen quickly by the 40-to-50-below-zero winter winds, and Birdseye noticed that they tasted fresh when thawed and cooked months later. He reasoned that the speed with which freezing took place was responsible, and filed the observation away in his mind for later attention. Upon investigation he found that fish had been frozen experimentally, but not commercially, by immersing them in brine. To avoid that undesirable step, he worked out a design for a belt-type froster, used it successfully at the Clothel Refrigerating Company of New Jersey and decided to go into the business in 1924.

With money borrowed on his life insurance and a $60,000 stake from three backers, he organized the General Seafoods Corporation and opened a shop in Gloucester. By 1926 he was quick-freezing cardboard packages of haddock by pressing them tight between two endless metal belts that were maintained at a low temperature by refrigeration. When thawed and cooked, the fish tasted fine and Birdseye began experimenting with freezing fruits, vegetables and meats. He solved most of the technical problems but couldn't sell his products. The public classed them with cold-storage foods which were in such bad repute that many states required merchants who handled them to display informative signs.

In the winter of 1928 the infant company still had on hand most of the 1,666,033 pounds of seafood that had



PROCESSING ORANGE JUICE
Although it reached the market only eight years ago, orange-juice concentrate now heads the list of quick-frozen foods, its production having reached 60 million gallons in 1953. A single Florida plant has the capacity to concentrate and freeze 400,000 gallons of juice daily. To reduce the pressure, in order to evaporate water from the juice at relatively low temperature, some enormous vacuum-producing equipment is employed. Seen at the right is an Ingersoll-Rand steam-jet evacuator that is 66 inches in diameter at the inlet end and 60 inches at the discharge end. The other picture shows cans of Birds Eye concentrate being placed in a freezer that operates at a temperature of minus 30°F.



FRIGID FISH STICKS

One stage in the processing of frozen, cooked fish sticks, which, although introduced only a few months ago, show signs of boosting the consumption of fish in the United States by 50 percent.

en quick-frozen during the preceding mmer. Birdseye and Wetmore Hodge, one of his backers, tried in vain to nvince people that their technique of st freezing captured freshness and cked it in. Concluding that the only ay they could obtain consumer acceptnce would be to induce a food distribing company to take over the venture, ey approached some of the leading eat packers and canners but were rned down because the cost of winning er the public was considered too great light of the risk of failure involved.

Finally, in June, 1929, following nuerous discussions, all the assets, includg the patents covering the quick-freeze rocess and the Birds Eye trademark, ere sold to the Postum Company, which ad previously developed a coffee subitute and such cereals as Grape-Nuts nd Bran Flakes. Postum rechristened self General Foods Corporation and ormed the Birds Eye Frosted Foods Division to take charge of the newly acuired corporate problem child.

Numerous obstacles had to be overome. Realizing that it was best to take ne step at a time, Birds Eye launched its aiden merchandising effort in Springeld, Mass., on March 6, 1930. Accomanied by a fanfare of publicity, it put n a 40-week selling campaign of 27 difrent products in eighteen stores. Ten emonstrators invited shoppers to taste efrosted strawberries that had been rozen in Oregon months before and to mell the freshness of chicken, steak and sh that had long reposed in freezers. urious crowds came, most of them to are at the stone-hard brick-shaped ackages, but many of them bought.

The Springfield trial convinced the ompany that the business had a bright uture, but additional problems arose. t was evident that Birdseye's 50-ton, ouble-belt freezing machine had to be eplaced by an improved, portable deice that could be moved readily from ne processing area to another. Laboraories were needed to determine which oods and which varieties were best ited for freezing—this because it had een discovered that they didn't behave ike in the freezer. A third requirement as better equipment to transport the rozen foods and to store them at low emperature in the places where they ere sold. For the Springfield test, enineers of the American Radiator Comany and General Foods had designed a orage case that cost $1500. Knowing hat grocers wouldn't invest such a sum introduce an unproved product, Genral Foods installed the cabinets free. A urth obstacle was the realization that e old prejudice against frozen foods ill lurked in the public's mind and ould have to be dislodged.

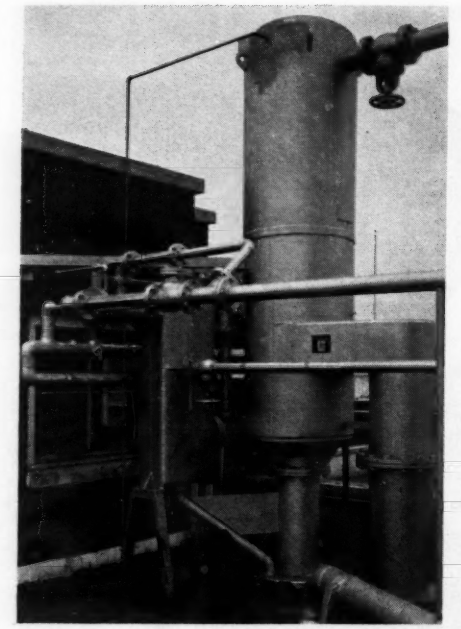
In 1933, the company faced some hard cts: it could count on little or no help promoting the new industry and would have to foot all the bills. In four years it had processed nearly 23 million pounds of foodstuffs but had acquired only 516 retail sales outlets, most of them in New England. Big sums had been spent on freezing equipment for copackers, to underwrite experiments for the first superinsulated railroad cars, to construct processing plants, to build a fleet of trawlers to expand fishing operations out of Boston. It had established a laboratory at Gloucester, where 22 chemists and food technicians were working under the direction of Clarence Birdseye. Much was being accomplished, but the main objective, national distribution, was still far away. Also, some mistakes had been made. General Foods went in heavily for frozen meats only to find that butchers wouldn't push them because they were afraid that would hurt their regular business. To make matters worse, the country was deep in a depression. In 1934, after five years in business, Birds Eye was bathed in red ink.

The turning point came when an unorthodox sales formula was mapped out by Edwin T. Gibson, who had taken over guidance of the division in October, 1933. At his suggestion, the volume of annual sales required to return a profit was established and found to be $10 million, which far exceeded the prevailing rate. Then, assuming that the goal could be reached, the lowest possible profitable retail prices were determined and put into effect.

Thus stimulated, volume gradually crawled upward, and as more production and marketing problems were overcome, the profitable operating point grew nearer. When a huge inventory of frozen peas accumulated, the price per package was slashed from 25 to 16 cents. The reduction attracted buyers of big institutions such as hospitals, hotels, and steamship lines, which then began to purchase other items. Moreover, thousands of people tasted frozen foods for the first time and many of them became customers.

Another pressing problem was solved when a storage cabinet was designed that held 450 pounds, sold for $300 and operated at little expense. To widen distribution, Birds Eye bought the cabinets and rented them to retailers. In the same year of 1934 was developed a 5-ton, 7-foot-square freezer with movable, drilled aluminum plates or shelves within which ammonia refrigerant circulates. The packages of food rest on the shelves, which are brought together by a hydraulic mechanism until each package is in contact also with the shelf above it. Quick freezing is thus effected. By the end of the year, sixteen of the machines were following the crops.

Introduction of products by areas continued, and by 1940 had progressed south to Miami, Fla., and west to Omaha, Neb., with 10,000 retail outlets. National advertising and distribution came soon afterward, and sales were stimulated when 24 percent of the country's housewives became defense workers and began looking for shortcuts in the kitchen. The armed services began to purchase such large quantities of frozen foods that the output for civilians was in doubt until it was shown that it took far more vital steel to can vegetables



FREEZING WITH VACUUM

Water boils at 212°F at normal atmospheric pressure of 760 millimeters (29.9 inches) of mercury. But if water at 60° is introduced into a closed chamber in which the pressure has been reduced to around 10 millimeters of mercury, some of it will instantly "flash" into vapor. In doing this, it absorbs heat from the remainder of the water, which is thereby cooled. If the vapor is removed as fast as it is formed and the reduced pressure is maintained in the chamber, the residue of water will freeze. This principle is used in the Freez-Vac process, developed by the Ingersoll-Rand Company, and is applicable for quick-freezing vegetables, fruits, and meats. Beech-Nut Packing Company utilizes it to process vegetables during the height of the growing season to provide a supply that can be drawn upon throughout the year for making canned baby foods. Pictured at the left are steam jets on top of a building and the head of a barometric condenser, both of which are used to produce the vacuum. The other view shows vegetables being charged into the receiving hopper of a Freez-Vac unit.

than to freeze them. The Government even urged people to buy frozen foods.

The result was a real boom which attracted a horde of fly-by-night opportunist processors. When frozen goods were removed from the rationed foods list on March 18, 1944, they literally flocked in to reap the harvest. In 1945 they numbered 450 and processed 1028 million pounds of edibles that included such precooked dishes as oysters à la Newburg, Welsh rarebit and sirloin tips with mushrooms.

There was a further increase in quantity and variety in 1946, and the market became glutted. Moreover, a lot of the foods frozen by inexperienced packers were of poor quality, and once a housewife was stung she was inclined to shun all brands. Wholesale deflation followed, and 200 firms folded up during the next two years because there was no market for the inferior products. This weeding out restored health to the industry, and by 1949 it was back to its 1946 sales level and standing on much firmer ground.

The rise of frozen orange juice to popularity has been truly amazing. It is not clear who conceived the idea of extracting 75 percent of the water and freezing the concentrate, thereby reducing canning, transportation and storage costs and enabling buyers to have the equivalent of fresh juice by adding three cans of water to each can of concentrate. The frozen extract was first marketed in 1946, but it now leads all frozen foods in consumption—about 1¼ billion 6-ounce cans a year. The concentrators are currently taking 47 percent of the Florida orange crop.

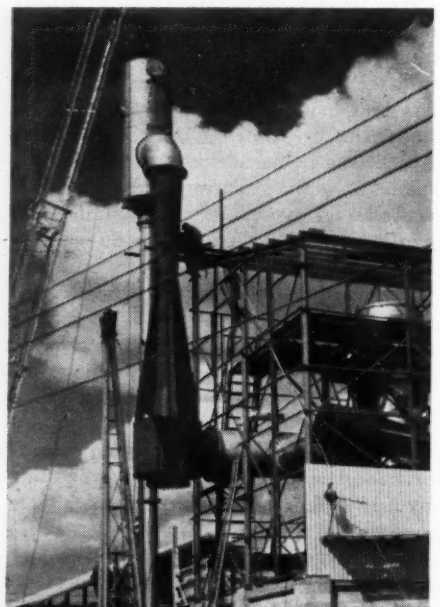
Sizable subsidiary developments feed on the success of frozen foods. Most remarkable of them is the refrigerated locker storage vault that rents space to individuals. The scheme originated in the farming areas. In 1936 there were 200 establishments; today there are 11,000 of them with three million lockers. Demand and rental prices reached their peak in 1944, then declined somewhat when wartime food shortages were eased. Iowa, with 840 plants, is the current leader among states.

Home freezing equipment has also grown fast, with sales of 6,362,000 units registered since the end of World War II. To serve small apartments, refrigerators are now obtainable with sizable freezing compartments. Total home freezer space in the country is estimated at 80 million cubic feet.

The number of railroad cars designed for moving quick-frozen foods increased from 10,000 in 1945 to 30,000 in 1952. During the past three years warehouses have increased cold-storage space by ten million cubic feet, nearly all of it in the "zero-space" category which now totals 225 million cubic feet—enough to accommodate from 8 to 10 billion pounds of foods.

Commercial freezing plants are in every state, with the greatest concentrations on the West and Gulf coasts and in the Northeast. Washington, Oregon, California, New York and New Jersey lead in vegetable processing, and the same states, with Pennsylvania, Michigan and Florida added, do most of the fruit freezing. Massachusetts tops the list in packing groundfish; Louisiana, shellfish. Next to orange juice in volume come peas, with 226 million pounds frozen in 1953. Strawberries account for 8 percent of all frozen-fruit sales, and have led the fruit list since they were first processed in 1931.

All told, producers froze 3.4 billion pounds last year, of which vegetables represented 30 percent; fruit juices, 17; poultry, 14; seafoods, 12; specialties, 9; meat, 5; and other miscellaneous foods, 13 percent. In all, 250,000 establishments handle frozen foods, but 75 percent of the business is done by chain stores and supermarkets which have 500,000 storage display cases. Hugh G. Davern, an executive of the Grand Union Company, a chain operator, declared at the luncheon mentioned earlier that equipment of this type in the average store in his group increased from 6 linear feet immediately after World War II to 120 feet in the newest supermarkets.

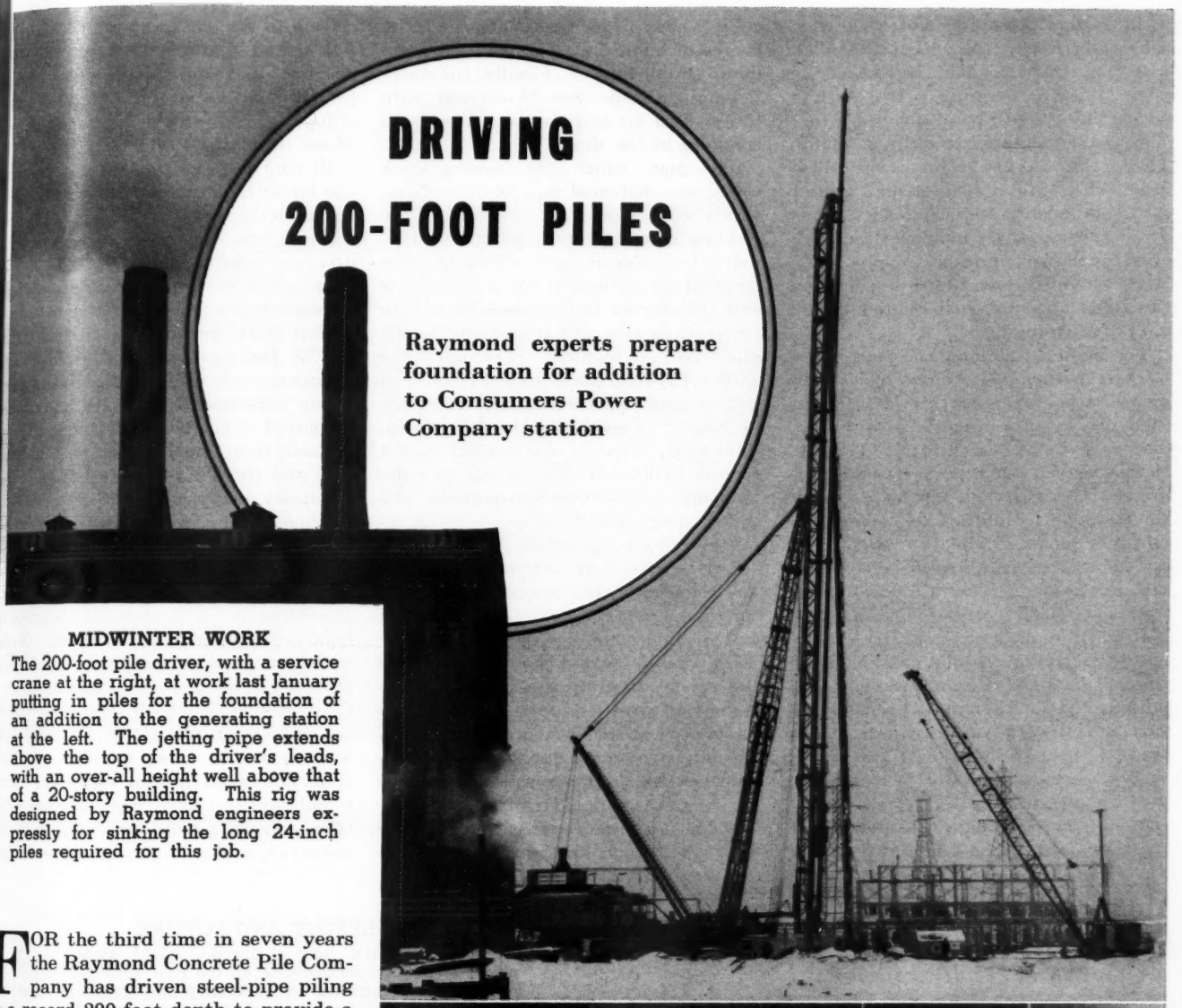


FLORIDA PLANT RISES

Erecting steam jet and barometric condenser to aid in evaporating orange juice. Note comparative size of man at top of steelwork for the building.

DRIVING 200-FOOT PILES

Raymond experts prepare foundation for addition to Consumers Power Company station

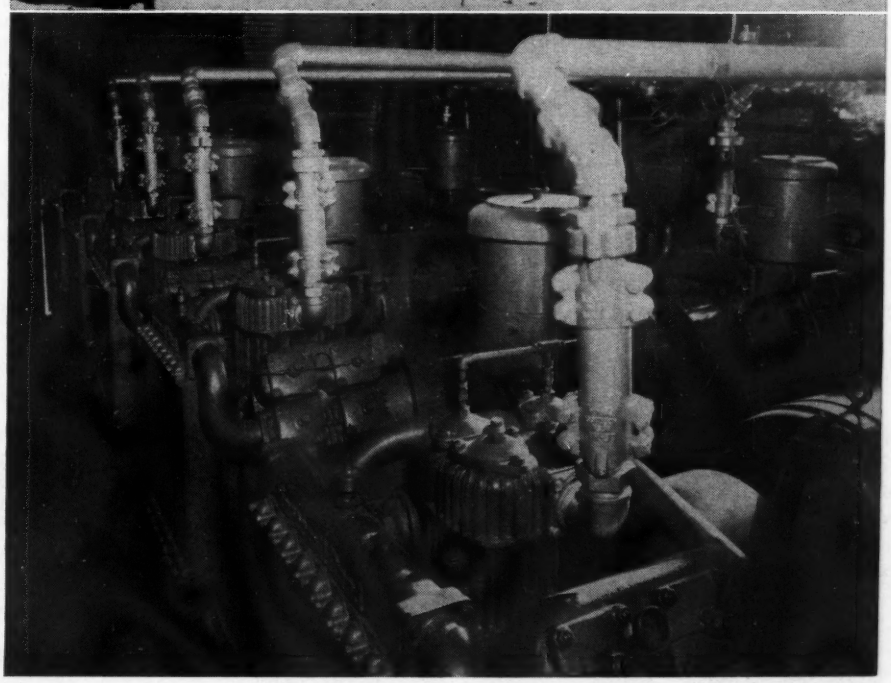


MIDWINTER WORK
The 200-foot pile driver, with a service crane at the right, at work last January putting in piles for the foundation of an addition to the generating station at the left. The jetting pipe extends above the top of the driver's leads, with an over-all height well above that of a 20-story building. This rig was designed by Raymond engineers expressly for sinking the long 24-inch piles required for this job.

FOR the third time in seven years the Raymond Concrete Pile Company has driven steel-pipe piling to a record 200-foot depth to provide a firm foundation for new construction at the Consumer Power Company's B. C. Cobb steam-generating station near Muskegon, Mich. The original plant of two 60,000-kw units was built in 1947. A third 60,000-kw machine was added in 1949. Current construction will increase the capacity by 135,000 kw and will provide space in which to place a fifth unit of at least 135,000 kw when it is needed. It called for the sinking of 385 piles, and in this respect was the largest of the three station-building jobs.

At the powerhouse site, a bed of muskeg soil extends 50 to 60 feet below the surface and is underlain by horizons of silt, peat, sand and clay reaching down to solid rock at a depth of about 200 feet, most of this mantle having been left there by retreating glaciers. The function of the piles is to transfer the load of the superstructure to the firm footing and to support an average of approximately 300 tons each. Herlihy Mid-Continent Company, of Chicago, was awarded the general construction contract, with Raymond holding a separate contract for the work of pile driving.

By the procedure followed, open-end



COMPRESSED-AIR PLANT
Compact installation of ten Ingersoll-Rand Motorcompressors, arranged in pairs, each with a centrally located 200-hp double-ended driving motor. These units operated a total of 18,000 machine-hours with no breakdowns.

24-inch steel pipes 180 feet long were sunk to bedrock, cleaned out and filled with concrete. This left the tops of the piles 20 feet underground, the level to which the site will be excavated before erection of the superstructure is begun. The rig that was used is one of the tallest in existence. Mounted on skids, it houses a 100-hp boiler to furnish steam for pile driving, has a tower and pile leads tailored for the job, and a jetting pipe. The latter extended some 65 feet higher than the leads and was surmounted by an aircraft warning light.

To facilitate sinking the long piles, workers with a water-and-air jet first pierced a hole to a depth of 120 feet at each pile location and drove a 40-foot piece of 30-inch casing into it, full length. It was cleaned out with water and compressed air, and then jetting was continued down to 150 feet. That done, a pile was picked up by the driver, inserted into the casing and driven entirely into the ground. Next a follower piece from 20 to 30 feet long was placed on top of it and the pile sunk to bedrock.

At that stage the pile contained the water-laden earth through which it had passed, and for its removal a combination air-and-water jet was gradually lowered to the bottom of it. The driver then went to work again to make sure that the pipe was seated on rock. After that, the 30-inch casing was pulled and the lower end of the pile sealed with 2 cubic yards of concrete deposited by means of an 18-inch-diameter, bottom-dump tremie bucket. Finally, the water remaining inside was blown out with compressed air and the pipe filled with concrete in the dry.

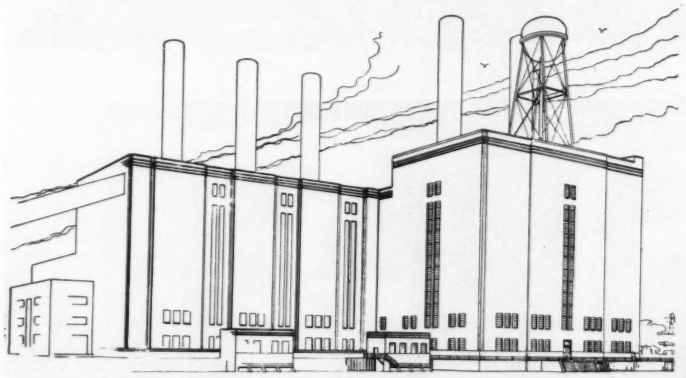
The pipe, which has ½-inch thick walls, was delivered in 40-foot sections, which were joined by the aid of ten welding machines to make up the 180-foot piles. A crane with a 75-foot boom handled the sections at the welding rack and transferred the finished lengths to the storage area and from there to the pile driver, as required. A second crane with a 125-foot boom served the 6-inch jetting pipe, which was 210 feet long, moving it to and from the driving rig.

The pile driver is a Universal with a special 15,000-pound ram that can deliver blows of 35,000 foot-pounds. Although compressed air was used intermittently, a large volume was needed. It was provided at 100 psi pressure by five Ingersoll-Rand air-cooled twin Motorcompressors. Each unit consisted of two machines coupled to the ends of a 200-hp motor located between them, and the whole assembly was mounted on a fabricated-steel baseplate. Their combined piston displacement was 5150 cfm. To supply so large a quantity of air periodically, the compressors discharged into six steel receivers, four of which measured 6x27 feet and the two others 5½x18 feet. A 10-inch line ran from the receivers to the working area. Water f jetting and cleaning was taken from th nearby Muskegon River, put under pressure of 125 psi by four 100-hp cen trifugal pumps and delivered to point of use through a 10-inch main.

Placing of the long piles was complete the latter part of May and the big ri was then shipped away. A smaller crew using lighter equipment, remained t drive miscellaneous shorter piles in th area to be occupied by transformers and in other parts of the building site.

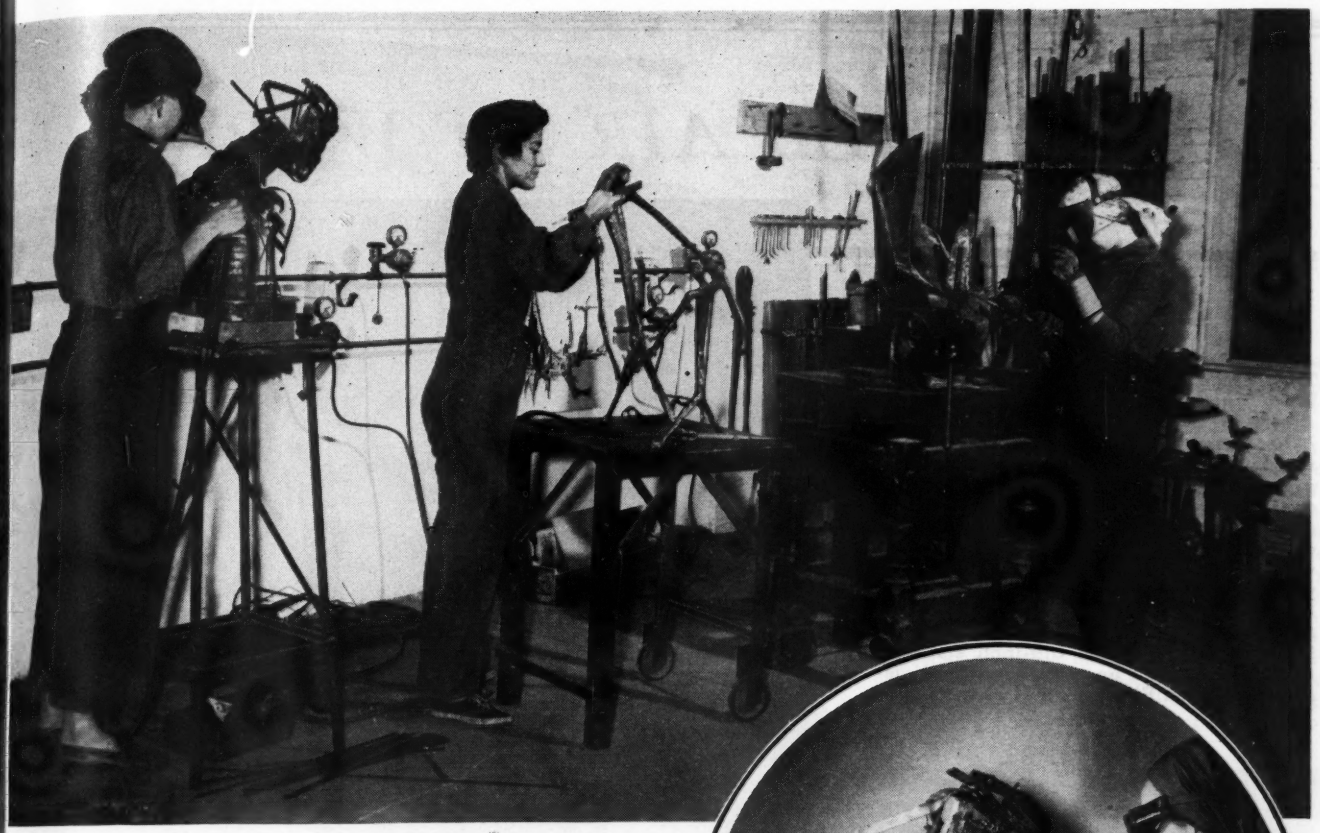
The work was in general charge of Ira W. Henderson, with Harold Blinco as superintendent. In addition to supervising personnel, about 130 men were employed at the peak of the operations.

Aside from the Detroit metropolitan area and the Thumb, Consumer Power Company supplies electricity in 63 Michigan counties constituting most of the state's Lower Peninsula. The B. C. Cobb station ranks among the four largest of its 53 generating plants which are connected by a state-wide network of high-voltage transmission lines. Within the company's service area are Grand Rapids, Flint, Saginaw, Pontiac, Bay City, Battle Creek, Kalamazoo, Jackson, Muskegon and other industrial centers, as well as many popular vacation spots and much farming territory. Both population and power consumption have been growing rapidly, necessitating continued expansion of generating facilities.



PRESENT AND FUTURE

Below is an aerial view of the B.C. Cobb station as it appeared before construction on the new addition (right) was begun. Facilities for receiving and handling coal are shown at the far left, and intake structures for condenser circulating water are just below the main building. The drawing shows how the enlarged plant will look. The extension will be about 25 feet higher and 80 feet wider than the parent structure, which is 121 feet high and covers a ground area of 39,000 square feet.



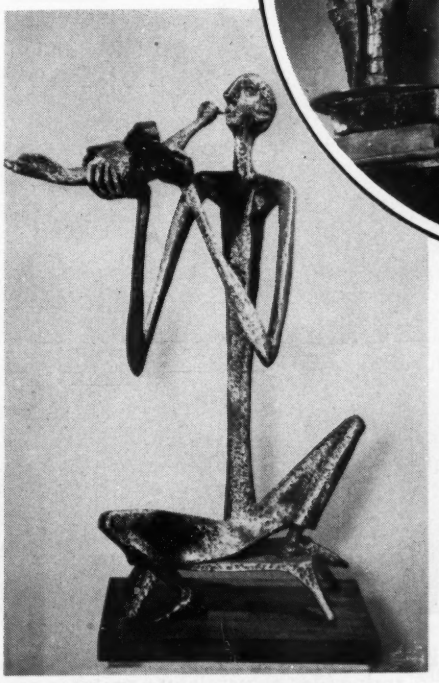
ARTISTS WITH BLOWPIPES

IN THE strict sense, to sculpture is to hew or cut, but the modern interpretation is broader. Figures or ornaments are not only carved from stone, wood, ivory or even soap but also molded of metals, plaster, ceramics and plastics. By the latest technique, works of art are fabricated with the aid of ordinary welding equipment. The artists use oxyacetylene blowpipes first to cut strip and sheet steel, bronze or copper into forms and then to weld them together into the objects of their conception.

This new kind of "sculpturing" originated at New York City's Sculpture Center, which remains its focal point. There the students give vent to their creative urge in a large room or "studio" that resembles an industrial welding shop. Oxygen and acetylene are piped to the welding stations from a manifold system located in the basement. Many of the practitioners are women, and several of them have become so skilled in the handling of the tools that they have obtained licenses from the city. Before attempting art-welding or direct metal-work, as it is called, each candidate must be skilled in sculpturing stone or wood.

The products range in size and style from small fragile wire forms to massive sheet-metal assemblies. While they are being made the pieces rest on stands or benches, and clamps and jigs are utilized to hold them when necessary. Special effects are obtained by the skillful use of the cutting torch and by puddling welding rod on the metal surfaces. Both steel fusion and braze welding of bronze and copper are employed, with the former predominating.

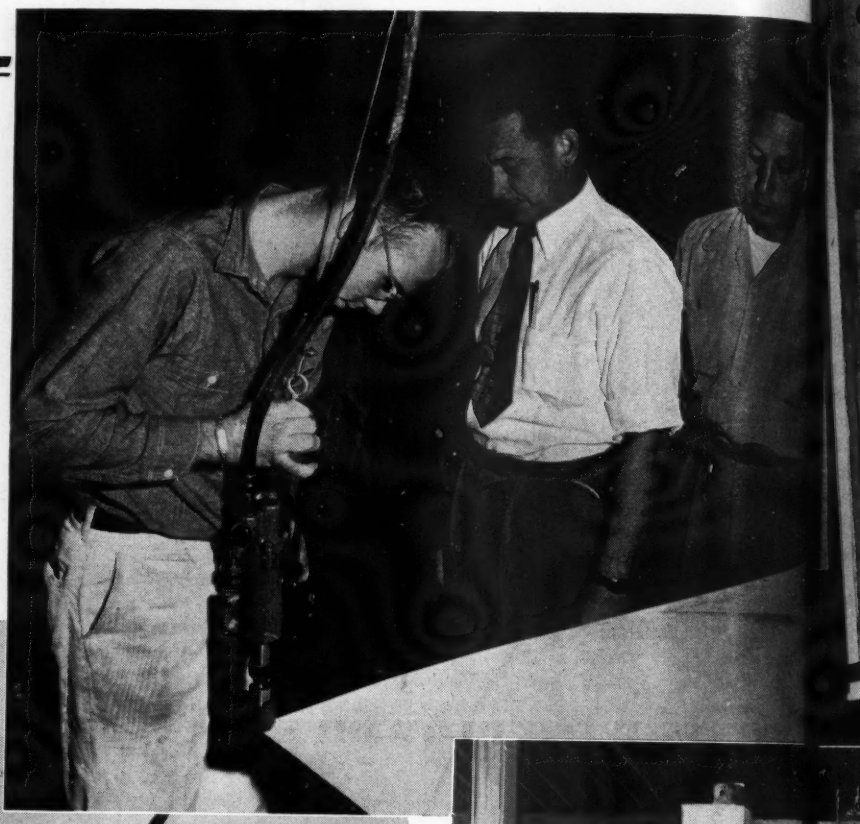
Professionals at the Center conduct regular classes in this new mode of expression. Many of the students have been faculty members of secondary schools and universities and they, in turn, have introduced courses in their schools. As a result, hundreds of persons, young and old and of both sexes, now practice the new technique throughout the country, and exhibits of their work are becoming fairly common. In just seven years art-welders have increased in number from about half a dozen to several hundred.



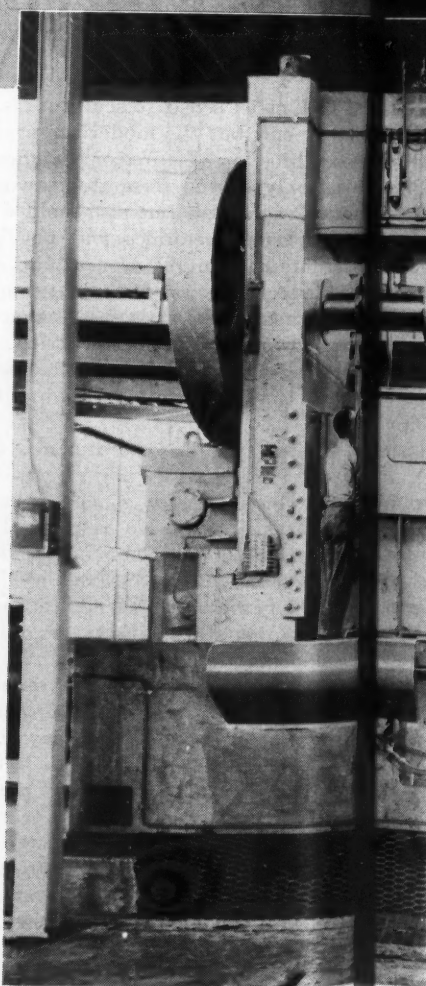
CREATING IN METAL

In the world's first "welding studio," the working tools and fittings are the same as those in thousands of industrial shops. The products, however, are different. The young woman in the circle is a licensed welder in New York City. The figure directly above is called Bird Man.

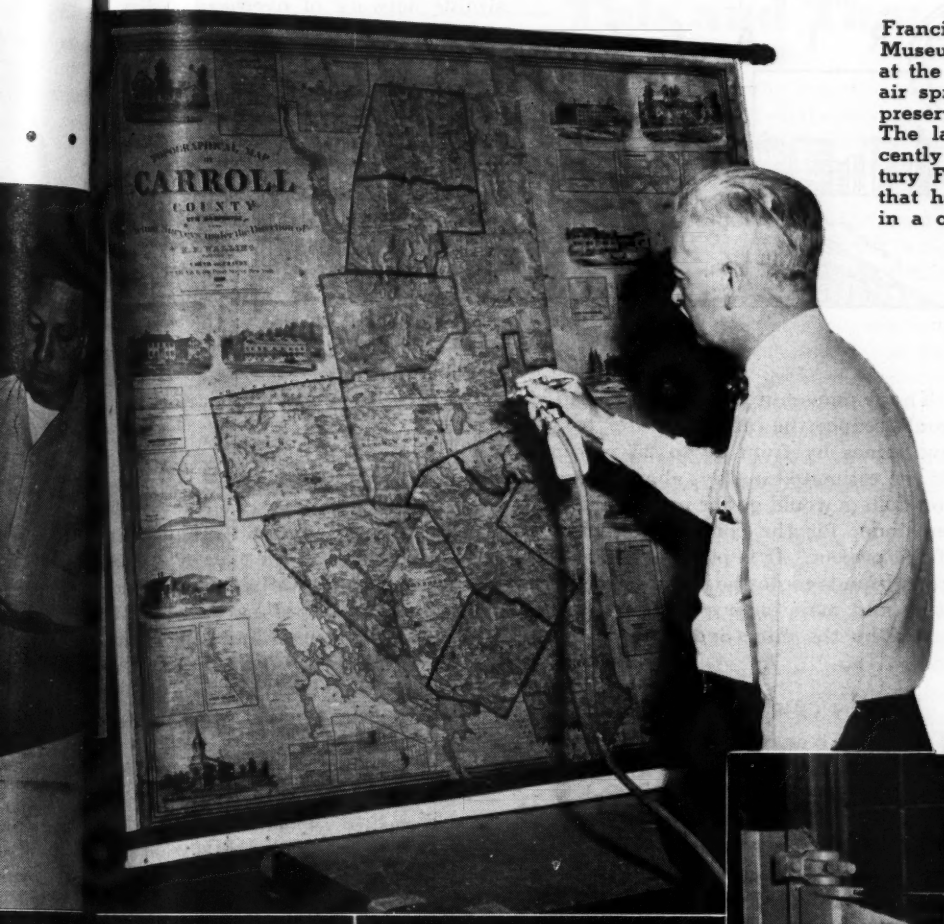
COMPRESSED AIR AT WORK . . .



The Boeing Airplane Company, at Seattle, Wash., uses numerous rectangular metal sheets for making phototemplates and it is necessary to round their corners for easier handling. When a hand-operated arbor press formerly used for the corner-cutting operation was replaced by the pneumatic device pictured (right), production was doubled to five cuts per minute and costs were reduced by an estimated $6500 per year. The tool, which was designed by Boeing's engineers, is powered by an Ingersoll-Rand air-buck riveter. Besides shearing metal as tough as 0.9-inch stainless steel, it cuts holes up to 5 inches in diameter in ⅛-inch Fiberglas and Micarta.

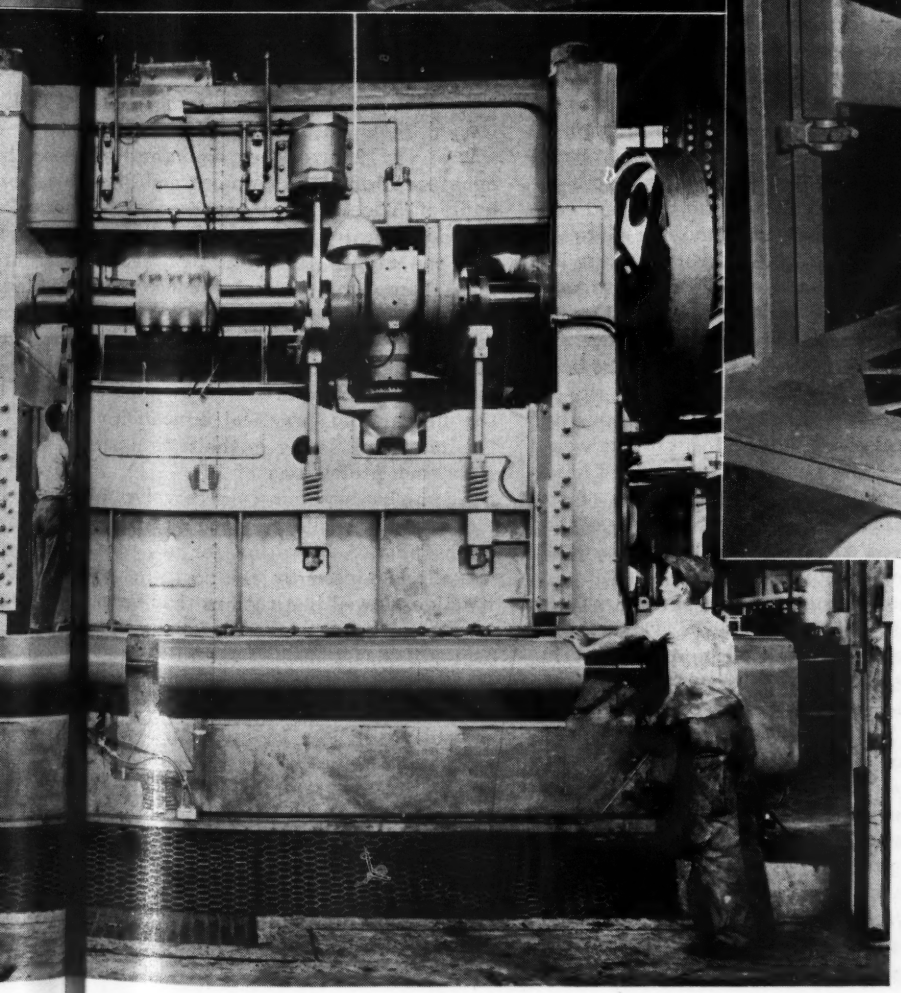


The lady shown above is using an air-powered machine to rivet pure silver electrical contacts to the tiny operating springs for subminiature switches produced by the Micro Division of Minneapolis-Honeywell Regulator Company, at Freeport, Ill. The springs are only 0.574 inch long, 0.144 inch wide and 0.003 inch thick, and for convenience in handling during processing are left in strips of twenty units each after being stamped from sheet beryllium copper. The operator is feeding a strip into the machine which supplies the tiny silver contacts from a hopper as they are needed. Each is inserted into an opening from below and then headed on both sides of the spring by an air hammer. Thickness of the entire contact is held to 0.042 inch.

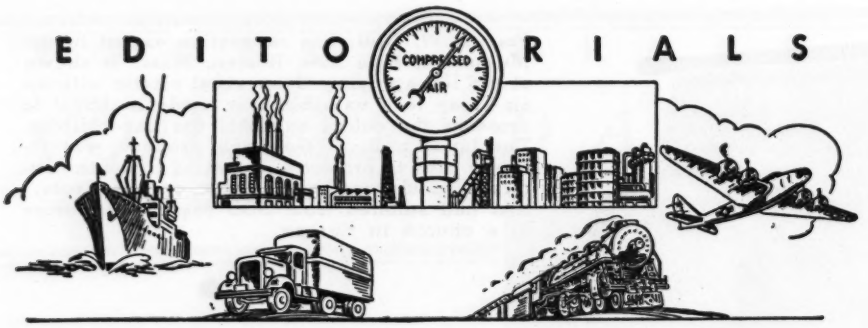


Francis W. Dolloff, a restoration expert in the Museum of Fine Arts, Boston, Mass., is shown at the left applying Geon vinyl plastic with an air spray to a valuable map made in 1860 to preserve the colors and seal the paper fibers. The latex, a B. F. Goodrich product, was recently used to protect a renovated fifteenth century Flemish woodcut, "Christ on the Cross," that had suffered from 500 years of exposure in a church in Europe.

With the aid of the fixture shown below rope commonly sold in hardware stores is packaged in a Colpack octagonal corrugated box at the Columbian Rope Company factory in Auburn, N. Y. The fiberboard box, made by Gaylord Container Corporation, comes in three pieces, which are assembled around a coil of rope. Closure is made by pneumatic pressure, as shown here. The operator is tying the top and bottom caps securely with heavy cord. The packages can be stacked to conserve space and rolled from place to place without getting the rope dirty. When a sale is made, the coil need not be removed, as the desired length of rope can be pulled out, without tangling, through a die-cut perforation at the top.



The ponderous contrivance illustrated at the left is reputedly the largest expanded-metal machine ever built. Its principal job in the shop of Penn Metal Company, Inc., Parkersburg, W. Va., is to slit and expand thick steel plate to form heavy, rigid grating, yet the 200-ton monster can produce the dainty Minimesh that is used in making ladies' handbags. The unit was designed by the firm's engineers and represents three years of planning and manufacture. Its automatic feed mechanism includes two large pneumatic cylinders that are mounted at the top on each side of the center. They are operated with air at 40-50 psi pressure.



AID FOR ANTHRACITE

WE WERE a bit conservative when we stated in our May issue that 19 tons of water is pumped from the Pennsylvania anthracite mines for every ton of coal hoisted. The actual figure is a whopping 48 tons, according to the Anthracite Mine Drainage Commission, which is made up of representatives of the coal-mine owners and the miners' union. The figure jumped from 27.1 tons in 1951 and only 14.4 tons in 1944. The reason for the rise is not so much that there is more water to contend with but rather that less coal is being mined, and the ratio of water to coal output consequently mounts.

The commission, which was named by the 1953 state legislature to study the economics of the hard-coal industry, reported that 1953 anthracite production was 30½ million tons, as compared with 100½ million tons in 1917. In the latter year, which marked the peak of the industry's prosperity, 179,000 men were employed, as against the present level of 49,000.

The report that contains these totals suggests a plan to alleviate unemployment and partly to solve the water problem. The proposal, which would cost an estimated $17 million, was offered as a temporary measure to be carried out because of the "uncertain present status" of the $350 million mine-drainage tunnel project that is being studied by the U.S. Bureau of Mines. There is no intention of dropping the campaign for that undertaking, but it is recognized that, even if favorable action is taken on it, many years will pass before it can become effective.

Meanwhile, the latest program put forward would, it is stated, give 2600 men employment for several years and reduce the cost of pumping water from the mines by $1¼ million annually. The scheme would include ditching and fluming aboveground to divert some surface water that now enters the mines, backfilling some abandoned properties, constructing underground dams and watercourses to control the flow that enters active mines from abandoned ones, and installing a series of pumping stations to dewater subsurface areas that are potential threats to active mines.

The commission said these measures would reduce the influx of water to active mines by from 20 to 25 percent. Of the estimated outlay, about six million dollars would go for pumps and the remainder for the construction phases of the project. It is planned to ask for federal funds to do the work, with operating and maintenance costs to be assumed by the mine operators.

ON OUR FEET AGAIN

HAVING emerged from the horse-and-buggy age into the automobile era, America may eventually find herself in the belt-conveyor period. These moving surfaces, that were conceived solely as industrial carriers, are now being applied to transporting humanity, as is mentioned elsewhere in this issue. Perhaps they will prove to be an answer to the pressing problem of urban traffic congestion and the reluctance of our people to walk more than a block or two.

Municipal authorities or merchants associations in various places across the country are studying the pros and cons of a scheme to provide moving sidewalks to give shoppers a lift from parking lots to business districts. The idea is to make it easier for them to get where they can spend their money. In some localities engineering plans have been or are being prepared. Some systems would run on and others below the surface, depending on local conditions. Most of them would cost heavily but might still pay off handsomely. Partly in anticipation of this potential flood of business, no less than eighteen firms are now producing belt-conveyor equipment.

The retiring president of the American Society of Civil Engineers, Dean Daniel V. Terrell of the College of Engineering at the University of Kentucky, predicted at the group's annual convention that New York City would have to go underground more extensively to avoid surface auto congestion. He recalled that the society's first president, James Laurie, who had an office on lower Broadway, proposed in 1868 that elevated railroads be constructed to overcome the delaying effects of bottlenecks caused by horse-drawn traffic. The first "El" was erected in 1878 and grew into a sizable network of overhead lines, but most of it has been torn down in recent years because of the growth in subway construction.

Now vehicular traffic in the busiest parts of the city moves little faster than it did around 1890, Dean Terrell declares. "Increasing population and increasing use of the streets," he says "have created the old problem in a slightly revised form. If the present trend continues, New Yorkers will soon be back on their feet, but in the best sense of the word. Passenger speedwalks or pedestrian conveyors below ground seem to offer the best accommodations."

EDUCATIONAL MILESTONE

MICHIGAN State College will observe its hundredth anniversary next year. It was the nation's pioneer agricultural college and, what is more important, it served as a pattern for our present system of publicly financed institutions of higher learning. Our first colleges were almost exclusively for the sons of wealthy families, most of whom were preparing for the professions. In 1855 farming was the country's foremost field of work, and the school that opened at East Lansing on February 12 of that year was called Michigan Agricultural College. It was the first one that was aimed at the potential needs of the common man. It marked the entrance of democracy into the realm of higher education.

In 1862 this new conception was extended to the entire nation by the passage of the Morrill Act, sponsored by Senators Morrill of Vermont and Bingham of Michigan. It granted to the individual states land that could be sold and the money used for the "endowment, support and maintenance of at least one college where the leading object shall be . . . to teach such branches of learning as are related to agriculture and the mechanic arts . . . to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

From this beginning have evolved 53 "land-grant" colleges with their new philosophy of education for all, which was also adopted by the scores of privately endowed institutions that sprang up across the country. As for Michigan State, it has marched steadily ahead. It is the ninth largest college in the United States with 15,000 students and a faculty of 2000. In addition, through extension courses, it serves 300,000 additional residents of the state annually. Its varied centennial program will continue throughout next year and include both an industrial exposition to portray progress through technology since 1855 and a similar presentation on farm mechanization with emphasis on present and future trends.

This and That

Whale Meat Now on the Menu

Whaling methods today differ widely from those practiced at the time of Herman Melville's *Moby Dick*, according to R. B. Robertson, whose new book, *Of Whales and Men*, relates the experiences of a winter spent as a crew member with a whaling fleet of seventeen vessels in the southern reaches of the Atlantic Ocean. While men and whales are the same, technique and equipment used in this exciting industry have been improved.

Compressed air enters into the procedure at the end of the chase when the crew of a "catcher" is faced with the problem of keeping its prize afloat. Blue whales and fin whales, which may weigh well over 100 tons, are now the main targets, states Mr. Robertson. The fastest species alive, they are said to sink quickly upon being killed unless buoyed up by man-made means. To avoid losing a valuable catch, the nylon lines attached to the harpoon are promptly reeled in, drawing the carcass to the side of the vessel. There a hole is punched into the belly of the creature and a pipe inserted through which hundreds of cubic feet of air is introduced to keep the whale afloat until it can be hauled aboard the "factory" ship for processing.

No longer burned as an illuminant, whale oil is in demand today because of its lubricating and medicinal properties. The aquatic mammal is the world's primary source of ACTH and cortisone, pituitary and adrenal hormones used in the treatment of diseases such as arthritis, bursitis and rheumatic fever. And now cubed whale meat is being shipped to some parts of the world because researchers have proved that the nutritive value of whalesteak is greater than that of beefsteak.

★ ★ ★

Dental Relief Promised

Getting teeth filled will probably never be a popular pastime, but it may be made less disagreeable by use of a drilling tool developed by the National Bureau of Standards. The device is a handpiece driven by a hydraulic turbine that spins a small dental burr at a rate of 61,000 rpm, as compared with a maximum of 6500 rpm possible with existing equipment. The faster speed results in greater cutting efficiency with less pressure. For example, a burr turning at 12,000 rpm will remove as much tooth structure in four seconds as one revolving at 2000 rpm will cut in 30 seconds. The lower pressure required reduces vibration and prevents overheating, and the patient will consequently suffer less discomfort. It also puts less strain on the dentist, and the high speed practically eliminates the tendency of the drill to climb or roll out of a cavity.

The turbine is located in the head of the tool and operated with water, which is circulated over and over by a motor-driven pump. In size and shape, the unit is comparable to a conventional drilling tool. Its development was part of a dental research program conducted by the Bureau in coöperation with the American Dental Association and the dental staffs of the armed services and the Veterans' Administration.

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Atlanta Dispatches Water

Since 1952, when Atlanta, Ga., occupied an area of 36 square miles, the city has annexed 94 square miles, which has necessitated the enlargement of its municipal water-supply system and its fire-fighting facilities. Now serving 465,000 people, the 82-year-old Department of Water Works draws water from the Chattahoochee River to be processed for distribution through some 1200 miles of water mains to consumers within Atlanta's 130-square-mile corporate limits, as well as for sale at wholesale metered rates to four other communities and four counties in the area.

A 5-year expansion program was initiated in 1952 to take care of the mounting demands. The need for records on operational phases and data for future planning led to the development of a central dispatching station which is located in the Water Works maintenance and distribution building roughly in the middle of the area served. There, at the nerve center of this public utility, the functioning of the entire system is observed, controlled and coördinated day and night by the aid of numerous gauges that are mounted on panel boards and that record water pressure at representative points throughout the network, water level in standpipes and elevated tanks, and pressure on the raw water mains at the Chattahoochee River pumping station and at repumping stations. All these, together with a totalizer showing rates of pumpage and other facilities, are integrated with fire-alarm signal equipment and the department's telephone switchboard and radio station KIC-300. The latter has been in service since 1949 and makes it possible to maintain constant communication with its twenty radio-equipped vehicles and four remote-control stations.

So far, 43 pressure gauges have been installed at important points such as firehouses, pumping and repumping stations, elevated tanks and standpipes. In the case of 21 of these, pressure readings, recorded on a field chart by means of an automatic fountain pen, are converted by a transmitter to time-impulse signals and electronically telemetered over leased telephone wires to the dispatching-station receiver where the signals are reconverted to pressure readings and indicated on a chart, again by automatic fountain pen.

While relatively new in the waterworks field, central dispatching stations have successfully served electric and gas utilities and pipe lines. Trouble anywhere in the system that will cause an appreciable drop in pressure is instantly recorded and made known to the operator on duty by a red light and alarm, enabling him to determine its source and to dispatch a maintenance crew without loss of time to do the necessary repairs.

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Pressurized Electrical System

A pressurized electrical system for use in explosive atmospheres has been developed in England by General Electric Company, Ltd. Basically, it consists of pressure-tight conduits or raceways filled with compressed air or a nonflammable gas and is self-policing in that any pressure drop will immediately cause a pressure-sensitive switch to open the circuit and halt the flow of current. For ease of maintenance, the system is divided into sections with a pressure switch incorporated in each one. This makes it easier to find a leak and enables other parts of the system to remain in operation. The company also has provided several different types of fittings and lighting units for the equipment. Although pressurization of complete systems has been tried before, it was unsatisfactory in earlier cases chiefly because of inadequate pressure-sensitive switches The new method uses air or gas at 3½ psi.

★ ★ ★

Bulk Vacuum System

What is called a "vacuum storage system" is being used at the Buckbee-Mears Company, in St. Paul, Minn., to provide vacuum for frames that keep screens for TV color tubes flat and wrinkle-free while they are given a light-sensitive treatment prior to etching. Six vacuum pumps exhaust air from an 850-gallon tank which is, in turn, connected to ten vacuum frames. Switches on a control board make it possible to cut out one or more of the pumps to meet variations in load. This setup replaces one in which each frame was

served by a separate unit and insures against shutdown of frames for lack of vacuum, permits locating the pumps some distance from the working area, and reduces installation and operating costs to a minimum. The system, which is believed to be applicable to other vacuum-dependent operations in industries such as plastics, packaging, bottling, photography and photoengraving was developed by Perfection Manufacturing Corporation, Minneapolis, Minn.

★ ★ ★

Disney's Pneumatic Monster

After viewing some fantastic Hollywood cinema effects, movie-goers often ask, "How do they do it"? Press dispatches have clearly answered that question in the case of a fight with a frightening sea monster in Walt Disney's forthcoming film of Jules Verne's *Twenty Thousand Leagues Under the Sea*. The make-believe giant squid that tries to swallow a submarine is animated by the liberal use of compressed air. The sea-green monster is 65 feet long and composed mainly of a plastic-and-rubber skin and of steel reinforcing. Inside is a maze of air hoses. Extending from the body are ten tentacles, each 40 feet long and weighing 175 pounds. These curl and lash about in a terrifying manner as air valves are calmly manipulated by 24 men sitting at a control board.

Ten stunt men atop the submarine take considerable pummeling from the pneumatic denizen of the deep, and several of them are flipped into the huge tank of water in which the spectacle is filmed. As a revolving mechanism churns up waves, air from a fan whips spray from their crests to create realism. The robot squid, claimed to be the largest phony creature ever made for the screen, was thought up by Robert Mattey, special effects man for the Disney organization.

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Rise of Belt Conveyors

A few weeks ago a "moving sidewalk" was placed in service to carry passengers arriving at one of the New Jersey stations of the Hudson & Manhattan Railroad, which runs underneath the Hudson River between that state and New York City. A similar but longer unit is being considered for installation in New York City to save passengers a walk of several hundred feet at the eastern end of a shuttle line that connects the east- and west-side subways.

Belt conveying of inanimate freight also is on the increase, and a 2-mile system will soon be put in operation in Tanganyika, East Africa, for transporting diamond-bearing earth from the Williamson Mine to a new processing plant. It is expected to move four times as much material as is being hauled by a fleet of 15-ton trucks, which sometimes get mired in the mud. The Williamson Mine, discovered in 1940 by John T. Williamson, a Canadian geologist, produces around $24 million worth of diamonds annually, or about one-eighth of the world's total. The conveyor was designed by Robins Conveyors (S. A.) Ltd., of Johannesburg, which is a subsidiary of the American firm of Hewitt-Robins.

Furthermore, the outlook for the most ambitious of all belt transportation schemes—a 100-mile line to carry iron ore southward from Lake Erie to steel-making centers on the Ohio River and coal northward—seems better now than it has ever been. The project received a setback in 1949 when the Ohio legislature declined to grant its backers permission to obtain land for a right of way. Recently, however, a candidate for governor, James A. Rhoads, declared in favor of the "rubber railroad," and Gov. Frank J. Lausche, who is seeking re-election, said he would sign a bill authorizing it if one is passed by the legislature.

The proposed dual-belt system would travel inside a housing of oval section with a runway in the center large enough for a special truck to transport maintenance crews. In most places it would be 20 feet above the ground, although it might dip into tunnels to pass through some of the higher hills. It would consist of a number of relatively short belt flights with their requisite pulleys and motors.

Moving at a rate of 600 feet per minute, the belts would carry 2400 tons of iron ore per hour or 57,600 tons (1150 railroad cars) per day. The capacity for coal, which weighs one-third as much as the ore, would be 800 tons per hour.

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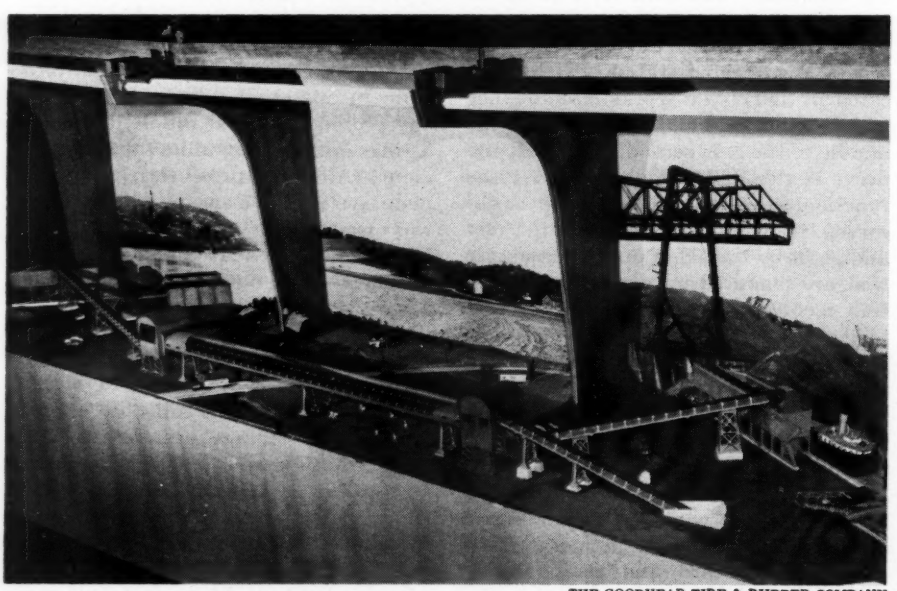
Novel British Windmill

A windmill erected temporarily near St. Albans, England, is of interest because of the novel way in which it harnesses the energy of the wind. A part of that country's research into ways of conserving coal resources, the mill drives a 100-kw generator whenever there is a wind of from 30 to 65 mph (winds of that intensity blow a good share of the time across the British Isles). Mounted on a high column is a hollow-bladed propeller. At the tips of the blades are escape holes through which air is expelled by centrifugal force as the screw whirls. The hub of the latter opens into a duct that extends through the tower, and thus an air flow of no mean proportions is induced in the duct. Mounted at the base of the column and turned by the air flow is an axial-flow air turbine which drives the generator. The propeller describes a circle 80 feet in diameter and sets up sufficient draft to begin producing electricity when powered by a wind of 1[illegible] mph. The unit reaches its top rated capacity at 30 mph and 95 rpm and maintains it through the range up to 65 mph, at which wind velocity the plant is shut down.



THE GOODYEAR TIRE & RUBBER COMPANY

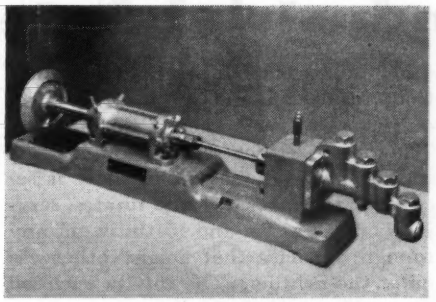
MODEL OF PROPOSED 100-MILE CONVEYOR

A miniature working model, containing 6776 working parts, that illustrates how the proposed 2-way belt railroad would transport iron ore and coal between Lake Erie and the Ohio River. Terminal loading and unloading facilities are shown at the two ends, and the central section indicates how the lines would be elevated in open country. A bill to make belt conveyors common carriers will be introduced in the Ohio Legislature in 1955. The model will be exhibited throughout the state in a trailer with a glass side.

Compressed Air Helps Dishmop Maker

PRODUCTION of dishmops by the O-Cel-O Corporation, a division of General Mills, Inc., has been stepped up from 1800 to 10,000 in an 8-hour day by a changeover from manual to mechanical operation. The mops consist of a cellulose sponge with a polystyrene handle held in place by glue in a solvent that was formerly injected into the slit sponge from an oil can controlled by a foot pedal.

Now, by use of semiautomatic equipment developed by company engineers, the sponges drop from a hopper which deposits one into each of a series of spring-tension holders arranged around the outer edge of an indexed table with a central knife-and-glue station. As the table revolves, each fixture is brought to a stop in front of the station by aid of a timing device, and a pneumatic cylinder pushes the blade into the mop. Simultaneously, the glue is forced through the hollow knife into the slit, into which the handle is inserted automatically by another special machine.



CONTROLLED-VOLUME PUMP
This unit draws the glue from a closed drum and injects a metered amount into a slit cut in the 2½x3xl-inch sponge at a pressure of 35 psi.

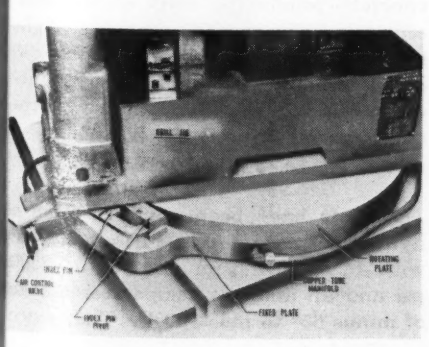
An air-powered, controlled-volume pump of the Roy type is used to apply the glue in metered amounts, something that could not be done with the oil can which poured out either too much or too little with the result that the solvent attacked the handle or the two pieces soon came apart because of poor adhesion. Added advantages of the new system are that it requires little maintenance and that, because it is closed, fumes do not present a problem.

Cushion of Air Serves as Thrust Bearing

COMPRESSED air is being used by Solar Aircraft Company as a substitute for a conventional thrust bearing between a heavy rotating plate and a fixed base plate on a multiple-spindle drill. The novel application was conceived by the plant's tool designers and is said to possess several advantages over the methods generally employed. How the "air thrust bearing" works is indicated in the accompanying illustration of an index table serving the drill jig that weighs about 200 pounds.

By opening the manually operated control valve, air at 90 psi is admitted into the copper manifold tube equipped with tees located radially around the base plate. This causes the air to flow between the two plates and to raise the revolving one approximately 0.005 inch, permitting it to be moved with ease to the next index point even by a woman and with little wear. When the air valve is closed, the air in the system escapes and the rotating plate again comes to rest on the base plate to provide a firm support during the drilling operation.

According to the company, it may be difficult at first glance to understand how this type of bearing can lift a heavy load in view of the fact that the total lifting force seems to be the product of the air pressure and the area of holes but ¼ inch in diameter. That would be correct if the plates were lapped for a perfect fit. In most applications on tools of this kind, however, the plates are machined and have minute grooves through which the air, after passing through the holes, can travel between the plates' contact areas. Because the differential between the inlet air and the exhaust air is around 45 psi, the effective pressure is 45 psi. This, times the contact area of the plates, is the actual lifting capacity. One caution must be observed in using this air thrust bearing: the joint between the plates must be sealed with felt wipers to prevent the admission of metal chips.



Sealing Irrigating Canals with Bentonite

ONE of the serious problems in connection with the irrigation of large tracts of farmland is loss of water through seepage. The West, long plagued with periodic dry spells, is especially water-conscious and is experimenting with an improved method of control based on months of laboratory work with bentonite conducted by the Central Nebraska Public Power and Irrigation District of Hastings, in coöperation with the U. S. Bureau of Reclamation and soil experts at Colorado A & M.

Bentonite, a puttylike material that swells as much as 35 times its original weight when wet, has been used to make unlined ditches impervious, but at a cost that prohibited general application. By the new procedure, the clay is ground fine enough to pass through a 200-mesh screen and then fed into a jet pipe where it is dispersed by innumerable streams of water at a pressure of 300 psi. The colloidal fluid is next pumped into a large basin where it is mixed with the irrigating water flowing into the canals to effect a seal as it soaks into the ground.

A ½-mile stretch of lateral near Smithfield, Neb., is the site of present field tests. If these are successful, it is proposed to treat 51 miles of ditches at a cost of nearly $3000 a mile, or at about 15 percent less than when bentonite is mixed with the soil and rolled in place.

Replaceable filters such as are commonly used in separators to provide clean, dry air are not embodied in The V.D. Anderson Company's new Type LC Hi-eF Purifier. This unit removes dirt and moisture by means of a combination stainless-steel element of the centrifugal and baffle type in a forged-steel body. Once it is incorporated in an air line near the pneumatic tool or equipment, it needs no periodic cleaning, not even inspection, it is claimed. Liquids and solids drain automatically into a float-type trap. The purifier is made for 1- through 2-inch-diameter piping for horizontal mounting and in a wide range of sizes for vertical installation, as shown in the accompanying illustration. It is indicated by an arrow and used with an Ingersoll-Rand Size 514V Impactool. Right of the latter is the drainage trap.

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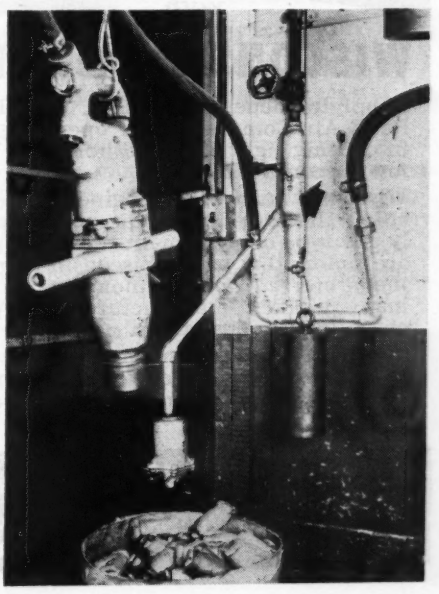
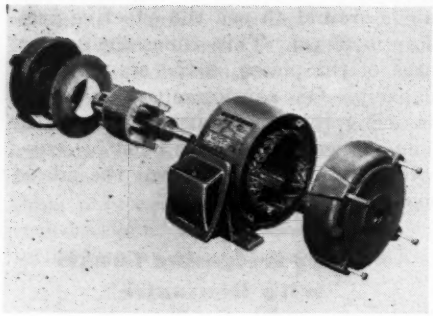


Industrial Notes



EXPLODED VIEW

Shown here is the Life Line-A drip-proof motor which is suitable for outdoor and indoor use where a totally enclosed unit is not required. The ventilating system is of straight-through design with the openings located so as to protect the motor from overhead drippings and to eliminate the need of a splashproof enclosure. Totally enclosed nonventilated and fan-cooled units also are available. The latter has radiating fins for maximum heat dissipation and a blower fan of molded glass plastic as a safeguard in contaminated atmospheres.

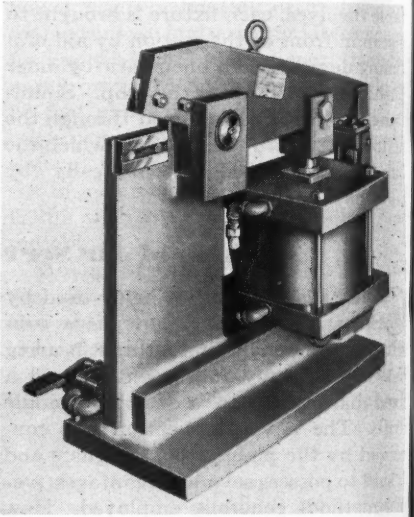
Westinghouse Electric Corporation has announced a new induction motor, the Life Line-A, which is designed to offer longer than normal service life and greater flexibility in application. Among the factors that contribute to these and other improvements are better ventilation, insulation and an inner and an outer seal on each side of the bearing. The former, attached to the outer bearing race, is stationary; the latter is secured to the inner race and rotates, serving both as a seal and to throw off any foreign particles that might otherwise enter the bearing. The totally enclosed motors in the line are provided with a bearing by-pass that prevents them from breathing through the bearing by equalizing the pressure on both sides of it. This, in combination with an external flinger, wards off contaminants.

Wire, coil, cable and stator insulation have all been changed. Bondar, a synthetic resin with extremely high thermal endurance is used for wire and is said to last three times as long as the materials that commonly serve the purpose. Coils are insulated with a combination of Mylar polyester and rag paper that has four times the dielectric strength of varnished cloth and much more heat endurance. Cable is covered with a lacquered glass braid which has an operating temperature of 167°F, or 27° more than that of the material formerly applied. To insulate the wound stator, it is dipped in Bondite, a phenolic-alkyd thermosetting varnish that has a far greater service life at elevated temperatures than the earlier type dips. By adding silicone, the coating is made water-repellent.

In conformity with the new NEMA standards for dimensions of motors ranging in size from 1 to 30 hp, the Life Line-A's are smaller per horsepower than their predecessors and also quieter in operation—in fact, two of the new units are said to produce the same sound level as one of the old design.

Circle 2E on reply card

For cutting cold ferrous and nonferrous bars up to 1¼ inches in cross section, Curry Air Shear Corporation has announced a machine that is designed for general production work and operated from a shop air line or compressor. Designated as Model A, it is equipped



with 6-inch knives that have four cutting edges and can be adjusted by set screws after grinding. The top knife head is actuated by a foot-controlled pneumatic cylinder using air at 60 to 125 psi. When the pedal is depressed, the knives are open to take the stock; when it is released, the jaws close, making for safety and economy. Pressure applied depends upon the work, 80 psi serving to cut mild steel 1 inch in diameter. Under normal conditions it takes two seconds to complete the cycle; but a shear with faster action for special applications is available. In addition to bar stock, the machine is suitable for cutting concrete reinforcing rods on big construction jobs and for processing light scrap for baling. It occupies only 15x36 inches of floor space and may be mounted on casters. The company makes another model, Type B, for hot bars.

Circle 3E on reply card

Patents have been applied for on a hydraulic or pneumatic pressure switch with an operating range of 400 to 3500 psi and an ambient temperature range of minus 65° to plus 160°F. The device

AIR

Delivers Double-Duty Service with

WISCONSIN-POWERED COMPRESSOR

Supplying dependable AIR-COOLED power for this P244 GH Ingersoll-Rand Air Compressor for operating a J-10 Jackhammer, engaged here in drilling light standard hole in a bridge pier, is a typical assignment for Wisconsin Engines.

Wisconsin heavy-duty engineered design and construction, *plus* dependable AIR-COOLING and ready adaptability to installation on practically any type of equipment requiring power components from 3 to 36 hp., are factors that make Wisconsin Engines the *preferred power* among both original equipment manufacturers and purchase-for-use customers.

You can't do better than to specify "Wisconsin Power" for your equipment. Descriptive and engineering data gladly supplied.

Power TO FIT THE JOB

Power TO FIT THE MACHINE

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

Circle 10A on reply card

is based on a new principle that is said to enable it, despite a weight of but 8 ounces, to withstand a maximum bursting pressure of 7500 psi without leakage. A product of PreReg Manufacturing, Inc., the unit responds to a minimum differential of 200 psi within its working limits. It is a normally closed single-pole double-throw switch rated for 10 amperes at 28 volts d-c at 50,000 feet.

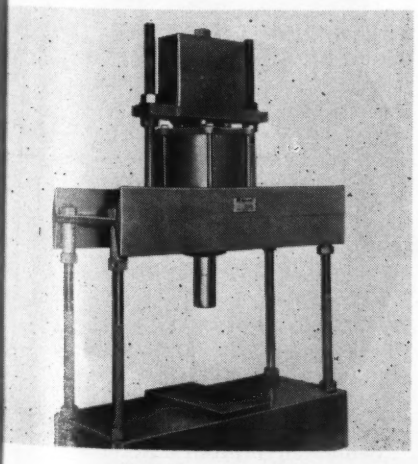
Circle 4E on reply card

A little pump that can be pushed around like a cart has been developed by Jabez Burns & Sons, Inc., to transfer viscous liquids such as chocolate to and from kettles, tanks, trucks and other processing equipment with low discharge points. Of the reversible helical-gear type, it is driven by a 1-hp motor and has a capacity of 17-20 gpm.

Circle 5E on reply card

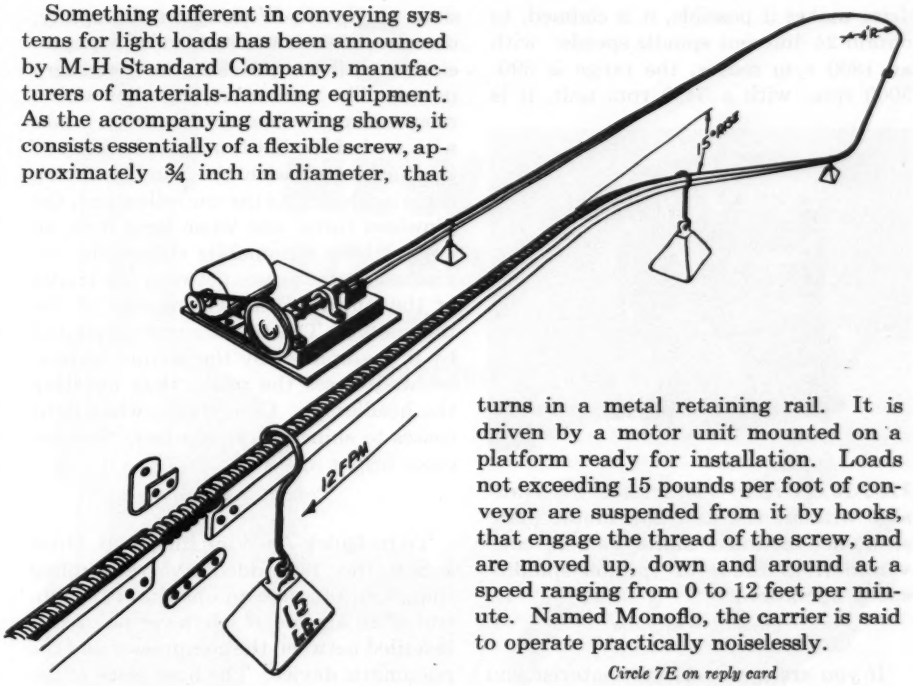
The weary salesman may soon get relief at the end of the day with Travel Talk, a device that is designed to help him get his daily report off to the home office in short order. For 25 cents dropped in a slot he gets a Dictabelt record complete with envelope for mailing, and another quarter starts the Dictaphone. The machine is installed on trial in a number of hotels.

Formerly built for individual use, Van Products Company is now manufacturing a heavy-duty pneumatic press of the bench type for industry generally. Known as the Power House Air Press, it is operated by a pneumatic cylinder with a 50:1 ratio and has an exclusive adjustable air-stroke limit control. The rigidly guided ram and frame are extensible, and the base has a removable plate for fixture, tool and die mounting. The press may be hand or foot controlled and is designed for any pressure adjustment from feather touch to 2½ tons. It is suitable for such varied operations as riveting, broaching, punching, stamping, crimping, bending, straightening and assembling. The work can be fed from any direction.



Circle 6E on reply card

Something different in conveying systems for light loads has been announced by M-H Standard Company, manufacturers of materials-handling equipment. As the accompanying drawing shows, it consists essentially of a flexible screw, approximately ¾ inch in diameter, that



turns in a metal retaining rail. It is driven by a motor unit mounted on a platform ready for installation. Loads not exceeding 15 pounds per foot of conveyor are suspended from it by hooks, that engage the thread of the screw, and are moved up, down and around at a speed ranging from 0 to 12 feet per minute. Named Monoflo, the carrier is said to operate practically noiselessly.

Circle 7E on reply card

Through the development of a V-belt drive arrangement, the Drill Unit Division of Rockwell Manufacturing Company has broadened the spindle speed range and adaptability of its standard air-hydraulic drill units. The accessory includes cast-iron pulley guards and a motor plate which accommodates standard NEMA rigid-mounted motors in compliance with J.I.C. machine building specifications. Using standard 4-step dynamically balanced pulleys, the new

¾-YD. SAUERMAN SCRAPER HANDLES ILMENITE AT 25 TPH

A Sauerman Scraper machine was selected to achieve profitable material handling by a large Eastern manufacturer of chemical products. Rapid shifting of the scraper about the 146′ by 311′ storage area is accomplished by a monorail and trolley system. The scraper is controlled by one operator who is in a safe location overlooking the storage area. He can reclaim the ore directly from the unloading trestle to the plant for processing, or he can stockpile the material until it is needed. Write for Field Report 224 describing this installation in detail. Find out how to reduce your storage cost.

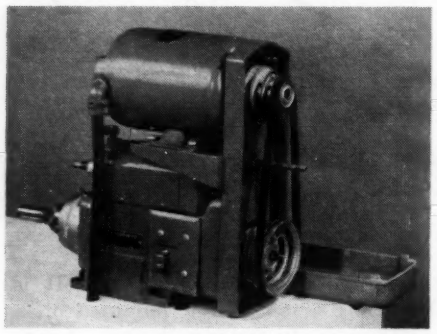
Contact Sauerman now on the best system for your requirements. For more information write for *32 Tested Methods of Handling Bulk Material and Catalog E, Scraper Storage.*

SAUERMAN BROS., Inc.

548 S. Clinton Street, Chicago 7, Ill.

Circle 11A on reply card

drive makes it possible, it is claimed, to obtain 24 different spindle speeds: with an 1800 rpm motor, the range is 590-5000 rpm; with a 3450 rpm unit, it is



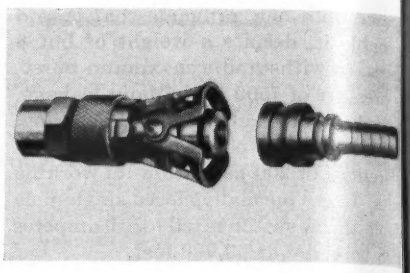
1180-10,000 rpm. The accessory is available without the cast-iron motor plate so a face-mounted motor can be converted from fixed- to variable-spindle-speed operation.

Circle 8E on reply card

If you are a considerate motorist you probably keep your left foot working overtime after dark pressing down the dimmer button and hope the driver of the oncoming vehicle will be as courteous. Now you can forget about your headlights, if you want to, and let an automatic dimmer lower and raise the beams for you. The latest type, produced by the Sparton Automotive Division of Sparks-Withington Company, uses two transistors instead of a photoelectric cell to provide the necessary power. The transistors, together with a relay and a pinwheel, are housed in a case with a window that is mounted on top of the dashboard with the window facing the windshield. As the car rolls along, the pinwheel turns, and when light from an approaching automobile strikes the device some of it passes between the blades of the pinwheel, activating one of the transistors. The tiny current generated by it is amplified by the second transistor and closes the relay, thus lowering the headlamps. Conversely, when light ceases to shine on the dimmer, they become bright again.

Circle 9E on reply card

To its Quick-As-Wink line, C. B. Hunt & Son, Inc., has added a valve coupling that is said to give an operator safe control of an air line at whatever point it is installed between the compressor and the pneumatic device. The nose piece of the jaw or valve half has an "O" ring that is held in a machined groove and slides into a recess in the connecting half. The joint is sealed tight by the internal fluid pressure acting on the ring, but the two hoses swivel freely without leakage to prevent kinking. The valve half is provided with locking jaws and a packed brass sleeve that can be moved back and



forth over the hollow, radially ported stainless-steel body. With the sleeve in the "on" or locked position on the coupling, live air flows through it; when at "off," the air supply is trapped in it, the flow stops and air is exhausted through open ports on the tool side. The sleeve can also be locked in the "off" position by a 90° twist so the hose line can be shifted without accidentally opening the valve. The manufacturer reports that the coupling is approved by safety authorities. It is available in ¼- to ¾-inch sizes with hose, or with male or female pipe threads, and can be used with air up to 250 psi.

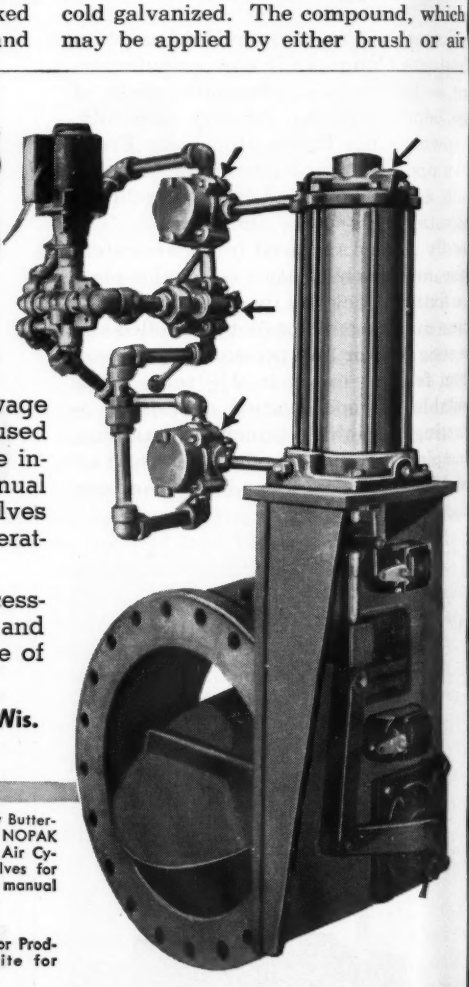
Circle 10E on reply card

By means of Dimetcote, an inorganic zinc preparation made by Amercoat Corporation, existing structures or equipment too large for hot dipping can be cold galvanized. The compound, which may be applied by either brush or air

R-S Butterfly Valves

to Regulate Flow of Liquids and Gases,

. . . *employ* NOPAK *Cylinders controlled by* NOPAK *Operating Valves*



In the chemical, paper, petroleum and steel industries, in sewage plants, water works and other utilities, R-S Butterfly Valves are used for fast, accurate flow-control of liquids, vapors and gases. In the interest of speed and efficiency, and to reduce or eliminate manual effort, the R-S Products Corp. of Philadelphia equips many of its valves with NOPAK Air or Hydraulic Cylinders controlled by NOPAK Operating Valves.

The R-S No. 789 Butterfly Valve pictured here is typical. This successful application may suggest how you can use NOPAK Valves and Cylinders in your plant operations, or to improve the performance of equipment that you build for others.

GALLAND-HENNING NOPAK DIVISION • 2759 S. 31st St. • Milwaukee 46, Wis.

Representatives in Principal Cities

NOPAK

VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

R-S No. 789 Heavy Duty Butterfly Valve equipped with NOPAK Model "D" 8" x 12" Air Cylinder and NOPAK Valves for optional solenoid or manual valve control.

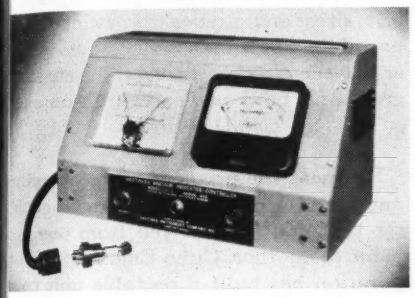
Refer to Sweet's File for Product Designers or write for Bulletin SW-2.

Circle 12A on reply card

spray, is said not to chalk, break down in sunlight or deteriorate appreciably with age. One application with a zinc content of 23 pounds per gallon offers sufficient protection against the action of salt or other corrosives.

Circle 11E on reply card

Hastings Instrument Company has announced an indicator-controller by which a vacuum system is automatically maintained in any preset range between 1 and 1000 microns of mercury. Typical applications of the instrument include the control of pumps in industrial proc-



esses where vacuum must be held within given limits, or the unit may be used to operate an alarm when the vacuum reaches either the upper or the lower level of the setting. Gauge tubes have noble-metal thermocouples and a nickel-plated housing which offer freedom from outgassing and system contamination. A logarithmic scale insures easy readability.

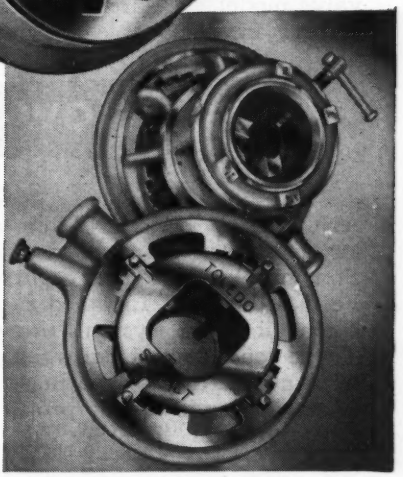
Circle 12E on reply card

Because the membership of the American Leather Belting Association has in recent years been extended to include manufacturers of mechanical leather packing and textile and other industrial leathers, the corporate name of the organization has been changed to National Industrial Leather Association, with Philip G. Rhoads of J. E. Rhoads &

"Young man, whatever happened to the 5:10 express?"

NEW Improved TOLEDO Simpact
1″ to 2″ Self-Contained Ratchet Threader

WITH *CAM-TYPE* PIPE HOLDER



★ *Improved* cam-type quick-action pipe holder has broader jaws for more positive grip on pipe.
★ Free action cam assures instant setting to any size—1″ to 2″.
★ Easy to center . . . you get perfect aligned threads.
★ Fewer moving parts . . . minimum wear . . . light in weight. Amazingly compact . . . will thread a pipe projecting through a wall as short as 6¼″.
★ Accuracy proven through the years . . . dies recede along tapered steps. A fine quality tool—yet low in cost! Write for new catalog. Order through your supply house. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

RELY ON THE LEADER . . . *all the way!*

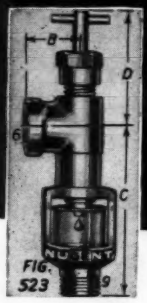
TOLEDO

PIPE TOOLS . . . POWER PIPE MACHINES . . . POWER DRIVES

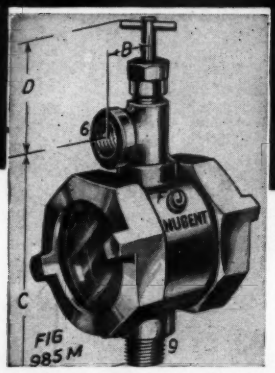
Circle 13A on reply card

See...Don't Guess

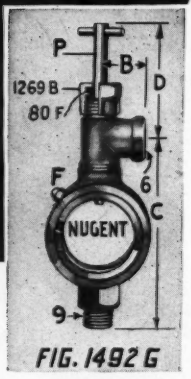
Install NUGENT Sight Feed Valves for LUBRICATION CONTROL



13 models designed for working pressures to 125 psi. Sizes to ¾ inch.



9 models for large machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.



Medium size needle type with steel valve stem. 9 models. Sizes to ¾ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

SIGHT FLOW INDICATORS

Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Feed Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.

Wm. W. Nugent & Co., Inc.

422 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Circle 14A on reply card

Sons president and William F. Mac Donald of E. F. Houghton & Compan vice-president. Headquarters will con tinue to be at 320 Broadway, New Yor 7, N. Y.

Norton Company has announced new vitrified grinding wheel—the Bond—for foundry use at speeds up t 6500 surface feet per minute. Accordin to the manufacturer, it gives up to 3 percent longer life with a faster, free cut than earlier units; requires less dress ing to keep it sharp; and corners hold up longer without rounding. The wheels are supplied in all sizes and shapes and grit sizes and grades for swing-frame, portable, floor- and bench-stand grind ers of the slow-speed type for snagging gray- and hard malleable-iron castings.

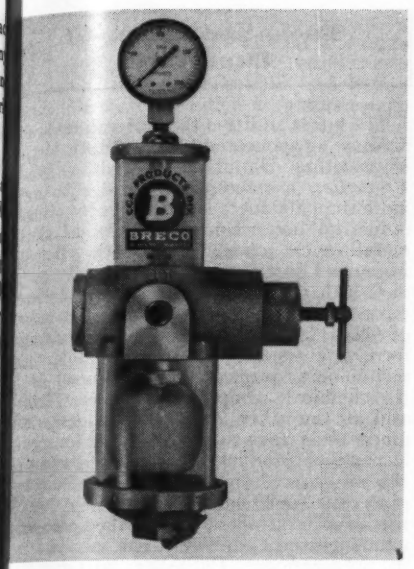
Circle 13E on reply card

To meet the needs of plant operators and maintenance men for a micronic fil ter that could be moved from one ma chine to another, Cuno Engineering Cor poration has built a portable unit com plete with pump, motor, filter, oil resis tant hose and gauges. It is suitable for

handling lube and hydraulic oils, cool ants and a wide variety of thin and heavy industrial fluids. The filter shown is the standard type with a ½-hp motor and a 4-gpm gear pump. It is guaranteed to remove all particles down to 25 micron in size. Special units with higher degree of filtration and capacities equipped with centrifugal pumps are obtainable.

Circle 14E on reply card

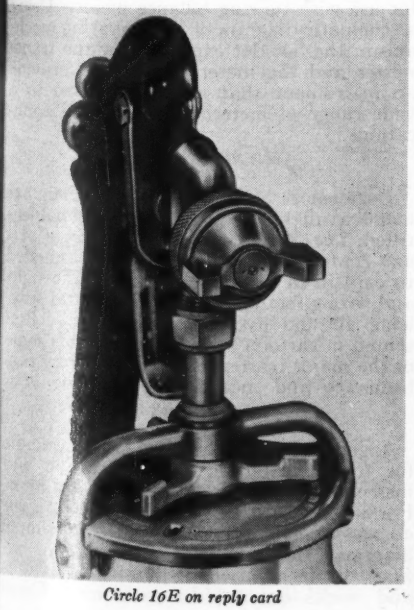
To eliminate complicated piping and fittings, CCA Products Division of Bres Manufacturing Company, Inc., has de signed a combination filter, regulator and lubricator for compressed-air line that requires but two connections. The regulator, of the piston type, is said to provide close control for equipment us



ing air at 0 to 100 psi in 2-pound increments and 0 to 200 psi in 5-pound increments. At shutoff, the valve automatically bleeds downstream to atmosphere. The filter unit can be changed quickly when dirty, which is indicated by a transparent bowl, and the oil reservoir can be filled without shutting off the air supply. The unit is available for ¼- to ¾-inch pipe sizes.

Circle 15E on reply card

Binks Manufacturing Company has designed an improved nozzle for siphon setup primarily on its Model 18 spray gun. The new Type 66SF has twin side ports that result in double atomization and a wide spray pattern which, together with lower back pressure at the point of atomization, speed up the flow of fluid and finishing by at least 15 percent. Other advantages claimed for it by the firm are: elimination of excessive overspray that usually collects on the face of the air nozzle, less time out for cleaning the gun, and reduced air consumption.



Circle 16E on reply card

VICTAULIC
METHOD OF PIPING

FOR GROOVED PIPE

Style 78
VICTAULIC SNAP-JOINT

New, boltless coupling — hand-locks — for faster hook-ups with no loose parts. Ideal for temporary or permanent lines. Sizes 1", 1¼", 2", 3", 4".

Style 77 & 77-D

VICTAULIC COUPLINGS **Style 75**

Style 77 & 77-D—The "general-purpose" couplings for standard applications. Simple, fast, reliable—sizes ¾" to 60".

Style 75—Light Weight Couplings—for low pressure, low external stress applications. Sizes 2", 3", 4".

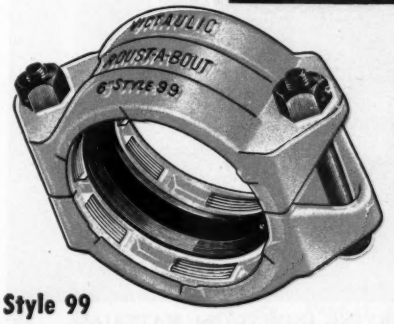
VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle, operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

VICTAULIC FULL-FLOW FITTINGS

Streamlined for top efficiency, easy to install—complete line, Elbows, Tees, Reducers, Laterals, etc., — fit all Victaulic Couplings. Sizes ¾" to 12".

FOR PLAIN END PIPE



Style 99
VICTAULIC ROUST-A-BOUT COUPLINGS Best engineered, most useful plain end joint on the market! Simple, fast, husky. Easy to install with any socket wrench. Takes strong, positive, bull-dog grip on pipe. Sizes 2" to 8".

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog and Engineering Manual No. 54-8B

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COMPANY OF AMERICA
P. O. Box 509 • Elizabeth, N. J.

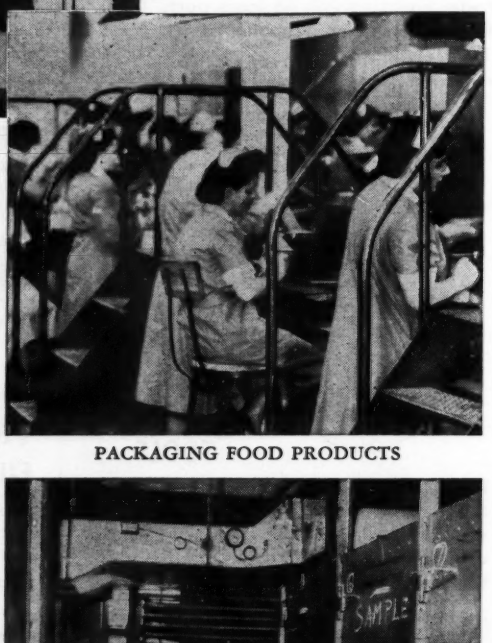
EASIEST WAY TO MAKE ENDS MEET!

Circle 15A on reply card

You can have DRY AIR with exact moisture control

ASSEMBLING ELECTRONIC PARTS

FOR YOUR COMFORT
FOR YOUR PROCESS
FOR TESTING MACHINES OR MATERIALS AT ANY TIME OF THE YEAR



PACKAGING FOOD PRODUCTS

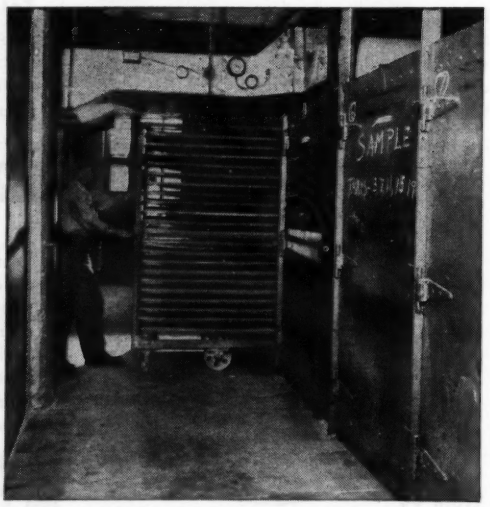
● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.



DRYING INDUSTRIAL MATERIAL

Write for Bulletins 112 and 122

NIAGARA BLOWER COMPANY

DEPT. CA, 405 LEXINGTON AVE. NEW YORK 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

Circle 16A on reply card

Books and Industrial Literature

The latest addition to the 4-volume handbook being sponsored by the ASME Metals Engineering Handbook Board is *Metals Properties*, a reference work dealing with more than 500 metals and alloys in common industrial use. Edited by Samuel Hoyt, metallurgical consultant of the Battelle Memorial Institute, it is a compilation of data hitherto available only in widely scattered books, technical reports and monographs. In convenient chart and tabular form, it gives the physical, mechanical and technological properties of each metal listed, its chemical composition, characteristics, and all the other information a design engineer must have to choose metals for specific parts or products. The other works in the set cover design function in metals engineering (published); processes by which metals are converted into finished products; and engineering tables. The last two are in preparation. Publisher, McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 36, N.Y. Price $11.00.

Complete information on many types of rubber hose and belting manufactured by Carlyle Rubber Company, Inc., is contained in a handy 24-page booklet that is being distributed without charge.

Circle 17E on reply card

Hewitt-Robins, Inc., has prepared for distribution a booklet—No. 135-A—describing and illustrating its line of Rockermount and Springmount vibrating conveyors for handling such materials as sand, shredded wood bark, scrap metal and red-hot steel castings. Technical details and capacity charts are included.

Circle 18E on reply card

Aluminum Company of America has published a 54-page book on its light-metals research which has enabled it to become a leader in its field. In addition to describing the work of its fourteen laboratories, *Research at Alcoa* contains a bibliography of books and technical articles written by its scientists on the subject of aluminum.

Circle 19E on reply card

Bulletin No. 9653-M issued by Hagan Corporation illustrates and describes a pneumatic signal transmitter designed especially for use with its ring balance meter. Using a schematic diagram of the operating mechanism, the booklet explains how the transmitter and the meter combine to provide an instrument that can be adapted to a wide range of metering and control applications.

Circle 20E on reply card

Logansport Machine Company, Inc., has made available a pocket-size manual entitled *The ABC's on Maintenance of Air and Hydraulic Equipment* which is intended to explain in a practical manner the right and wrong methods of setting up and servicing air and hydraulic equipment. Presented in cartoon style, it emphasizes some of the major reasons for unsatisfactory performance and means of preventing it.

Circle 21E on reply card

Ingersoll-Rand Company has available for free distribution two interesting and instructive booklets on centrifugal pumps. Form 7287, entitled *Centrifugal Pump Fundamentals*, explains with the aid of simple diagrams the principles of operation, defines the terms used in pump calculations and works out typical problems. Form

7123 is a "slide film" between covers on how to select a Motorpump for a specific job. There are 56 pictures, charts and curves that show how a unit is built and how it works; illustrate the different factors (quantity, pressure, friction losses, head) that must be considered in making a choice; and present a typical problem and its solution.

Circle 22E on reply card

The engineering properties of corrosion-resistant "S" Monel are discussed in a booklet offered free by the Development and Research Division of The International Nickel Company, Inc. This casting alloy is said to offer unusual strength, hardness and anti-galling properties at temperatures up to 1100°F.

Circle 23E on reply card

A 44-page booklet on cutting and grinding procedures is inserted in a brochure offered by Master Chemical Corporation, manufacturer of Trim coolant. Charts and graphs show recommended concentrations for machining different metals and give information on how to increase production and prolong tool life.

Circle 24E on reply card

Super-Silvertop steam traps, together with self-cleaning strainers, are discussed in Bulletin 154 obtainable from The V. D. Anderson Company. It is intended to aid engineers, maintenance men and plant operating personnel in making the right selection. Tables of specifications, weights and pressures are included.

Circle 25E on reply card

A catalogue on high-pressure lubrication equipment designed especially for servicing lubricated valves has been prepared by the Alemite Division of Stewart-Warner Corporation and can be obtained from Alemite distributors and jobbers. Different kinds of fittings, extra-heavy-duty guns of the lever and bucket types, hose assemblies, pressure gauges and other accessories are comprehensively described and illustrated.

Circle 26E on reply card

A pocket-size catalogue illustrating and describing Kennett Equipment & Machinery Company's complete line of manual handling equipment such as trucks of various kinds, work boxes, racks, etc., is now available. More than 40 different units are pictured, together with construction and design features. One section is devoted to

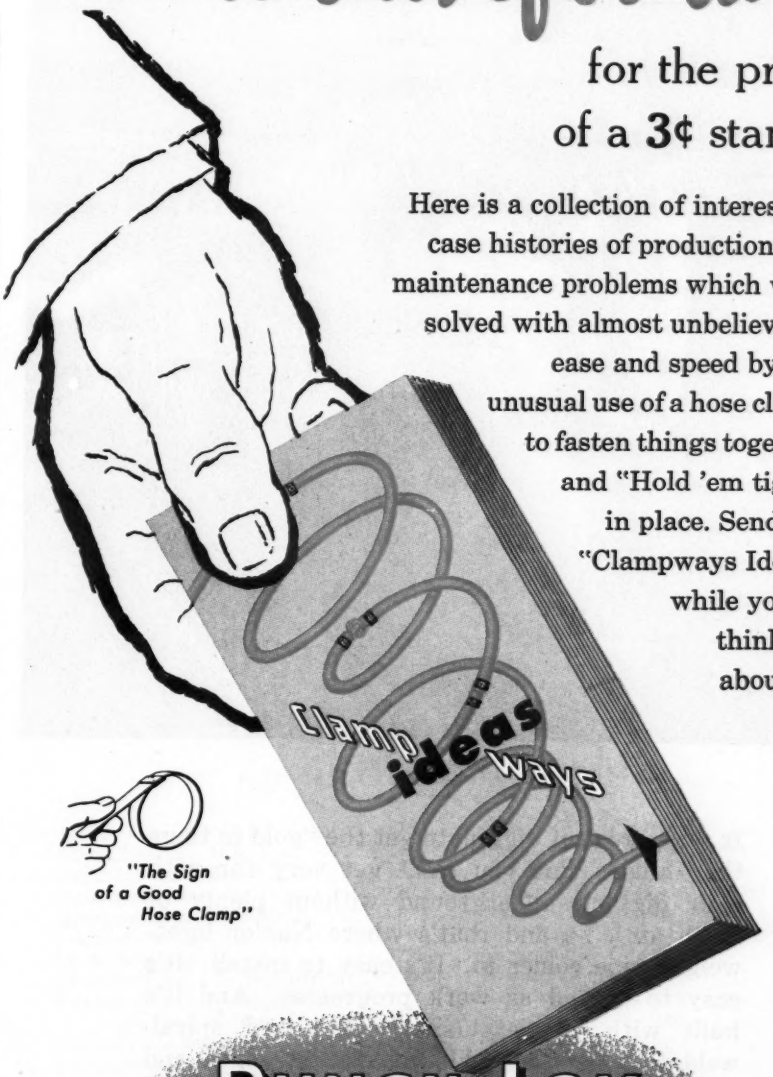
"The gopher that dug that hole is the champ of them all."

ideas...worth

hundreds of dollars

for the price of a 3¢ stamp

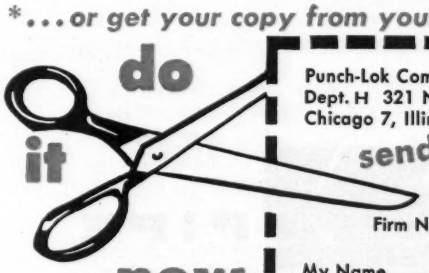
Here is a collection of interesting case histories of production and maintenance problems which were solved with almost unbelievable ease and speed by the unusual use of a hose clamp to fasten things together and "Hold 'em tight" in place. Send for "Clampways Ideas" while you're thinking about it.*



"The Sign of a Good Hose Clamp"

PUNCH-LOK Company

*...or get your copy from your near-by Punch-Lok Distributor.



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Dept. H 321 North Justine Street
Chicago 7, Illinois

send me Clampways ideas FREE

Firm Name _____

My Name _____ Title _____

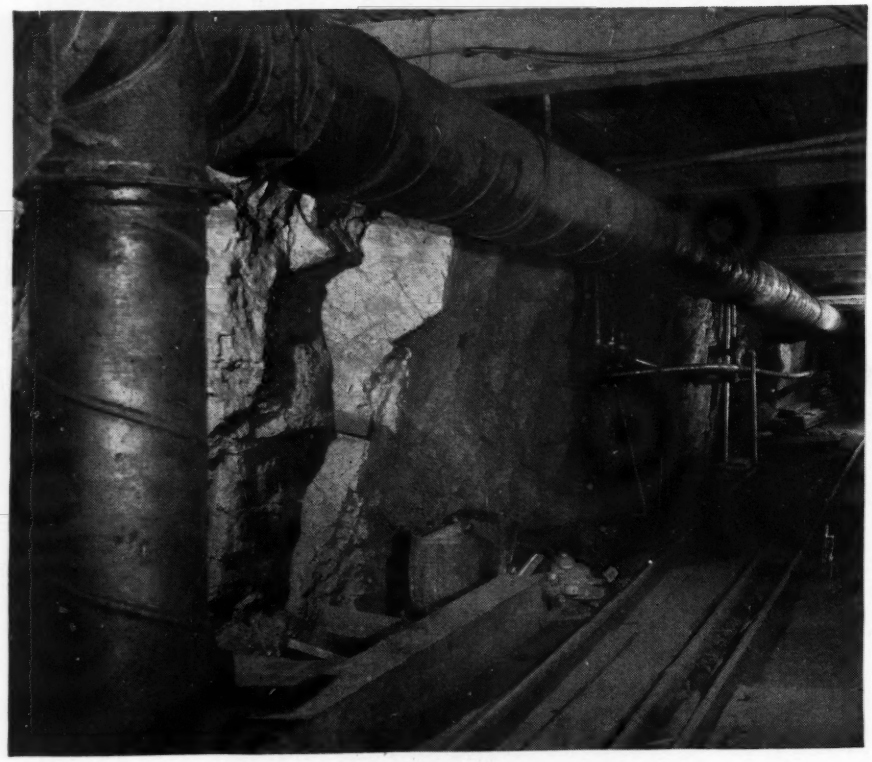
Address _____

City _____ State _____

4800

Circle 17A on reply card

AIR TO A FORTUNE



It takes a lot of diggin' to get the "gold in them thar hills". But you can't get very far with your digging underground without plenty of fresh air . . . and that's where Naylor lightweight pipe comes in. It's easy to install. It's easy to extend as work progresses. And it's built with the exclusive lockseamed spiral-welded truss that adds collapse strength and safety needed for push-pull ventilation. Find out today how much more Naylor pipe and Naylor one-piece Wedge-Lock couplings offer you for your air lines. Write for Bulletins No. 507 and No. 514.

NAYLOR PIPE

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 18A on reply card

details of the company's new type of caster for use where continuous wet conditions are encountered.

Circle 27E on reply card

Bulletin No. 265, prepared by Burgess-Manning Company, deals with its new line of silencers designed to eliminate high- and low-frequency noises caused by high-velocity exhaust from steam and air devices. Known as the Series ADS, they operate on the patented Burgess-Manning snubbing principle and embody special acoustic reactance chambers and sound-absorbing material.

Circle 28E on reply card

Sharon Steel Corporation is distributing a booklet covering the properties and applications of its hot-dipped, zinc-coated steel Galvanite which is available in both sheet and strip form. The product is said to possess high resistance to atmospheric corrosion and to provide an excellent surface for paint or baked enamel. It can be welded, cold-formed or soldered.

Circle 29E on reply card

Bulletin WC-115 published by Graver Water Conditioning Company, a division of Graver Tank & Manufacturing Company, Inc., deals with its diatomite filters for the removal of oil from boiler feed water and condensate, the clarification of moderately turbid process water and the purification of drinking water, as well as for use in swimming pools and for secondary crude-oil recovery. Typical arrangements are shown.

Circle 30E on reply card

Johns-Manville is offering a new edition of its industrial products catalogue which supplies essential data on the following: insulation, refractory products, asbestos-cement pipe, packing, gaskets, electrical products, friction materials, roofing, siding, flooring, partitions and ceilings. Text and diagrams have been revised to give the latest information in a compact, easy-to-use form.

Circle 31E on reply card

Penn Metal Company, Inc., has issued a 28-page catalogue covering its complete line of standard and flattened expanded metal and expanded-metal gratings. Among other information it contains tables of sizes, weights and dimensions for different meshes in carbon and stainless steel, aluminum, Monel and Inconel and many illustrations showing the innumerable ways in which expanded metal is used today for domestic and industrial purposes.

Circle 32E on reply card